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ELECTRICAL REVIEW

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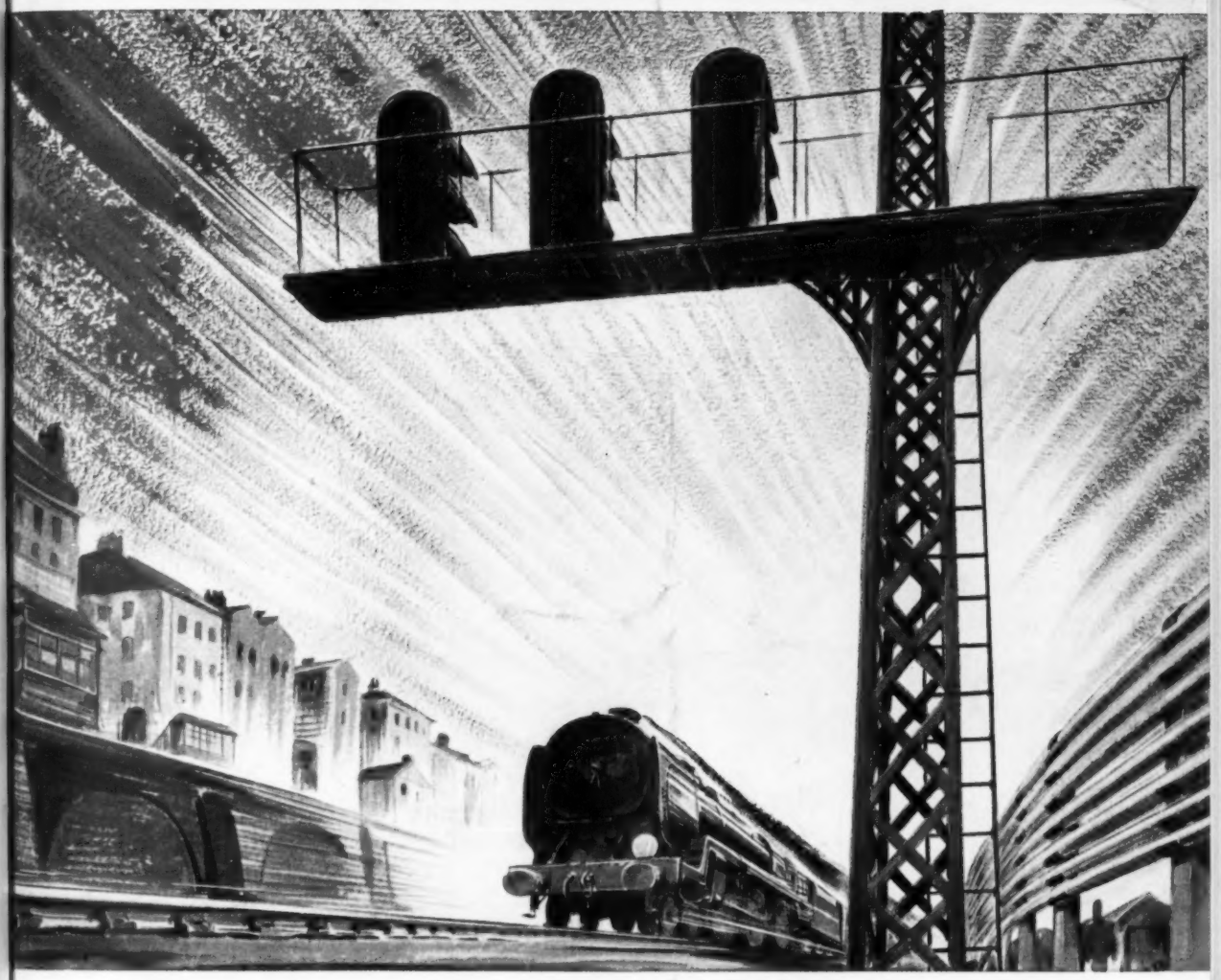

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ELECTRICAL REVIEW

30 October 1959 Vol. 165 No. 12 Established 1872

Clean Air and Electricity

RECOGNITION of the ill-effects of polluted air on health and general economy has greatly increased in most countries during the past few years. The view, at one time often expressed, that " where there's muck there's money " has suffered almost complete reversal with the advance of medical science and of engineering appreciation of the cost of waste due to the emission of noxious gases from chimneys. Education of the public, including those with higher administrative responsibility, owes much to the voluntary efforts of the National Society for Clean Air (formerly the Smoke Abatement Society), which celebrated its diamond jubilee last week. Having regard to the pioneering work and consequent experience in Great Britain (acknowledged abroad), it was appropriate to mark the occasion by the holding of an international conference in London, as reported in this issue. Overlapping details in some of the papers presented for discussion by the authors from many countries was perhaps inevitable, indicating a need for some central form of co-ordination, but there was enough diversity among them to provide data of considerable value. In other cases the causes and effects of pollution were shown to be peculiar to local conditions, such as climate, types of industry and habits of the populations.

We can deal here only with the aid that electrification can bring to solving the main problems. In its applications electricity, of course, is innocent of offence. An illustration of what should be the general trend was the prominence given on the stand of the Electrical Development Association to off-peak under-floor warming of houses which offers the additional advantage of load factor improvement so necessary to get the greatest economy in future nuclear generation. A further example will be the changeover of the railways from steam operation, thus getting rid of the emissions from short stacks, since a cardinal factor in improvement is chimney height. The low chimneys of domestic premises pin-point them as usually the major offenders.

A corollary to the use of electricity derived from the public supply mains is that the heavy concentration of combustion in a relatively few power stations should not offset to any significant extent the advantages of

cleanliness of electric operation by consumers. Apart from the advanced design and increased technical skill employed in large modern boiler houses, available evidence is that, with the present methods of emitting hot gases having associated high buoyancy and therefore high velocity up tall chimneys, power stations add little, if anything, to local pollution, even in really bad atmospheric inversions. This conclusion is supported by tests carried out by means of continuous measurement and recording instruments developed at the Leatherhead laboratories of the Central Electricity Generating Board. Kelvin's dictum to the effect that when we can measure anything we begin to know something about it may be recalled.

MINISTER FOR SCIENCE

At a Press conference last week Lord Hailsham, who has been appointed Lord Privy Seal with responsibility for the co-ordination of the activities of Government Departments in the fields of science and technology (which includes research), described the purpose of his new assignment. He gave an assurance that, although as Lord President of the Council, he had been concerned with scientific matters it would be wrong to suggest that "new presbyter is but old priest writ large."

Lord Hailsham insisted that he could not be expected to bring about remarkable results in a very short time but he was convinced that there was need for a policy for science. He thought that at present Government science, and perhaps all British science, was too parochially minded, lacking in the broader vision. With the aid of the Advisory Council on Scientific Policy he would try to tackle such questions as whether the general balance of scientific effort was right or could be better deployed. He hoped to show a personal interest in the applied research of private industry and industrial research associations carried out under the general authority of the Department of Scientific and Industrial Research, and he had ideas for the forging of closer links between Government research organisations and the universities.

Our impression from the conference is that at present Lord Hailsham is feeling his way in the extension of his former activities and that he intends to exert a great deal of personal influence upon those whose co-operation is sought.

CO-OPERATION IN DESIGN

As a material for lamp standards aluminium is much less common in this country than on the Continent or in the United States. Nevertheless its use is growing and at the recent conference of the Association of Public Lighting Engineers 15 per cent of the columns exhibited were of aluminium. A principal advantage is that a considerable reduction in the weight of a column is possible with consequent savings in time, labour and plant in erection. Less obviously, the ease with which aluminium can be fabricated enables lantern manufacturers to produce their own columns and thereby achieve a greater unity of design.

The scope this material offers for technical and artistic originality in street lighting has been hardly touched on, however. Most entries in the competition organised by the Aluminium Development Association (see page 563) failed because they were either the work of architects or students with little knowledge of engineering or of engineers lacking artistic training. Significantly, the designs which secured the first prize were the combined effort of an industrial designer and an engineer. In the words of the assessors, "team work between specialists is essential if designs are to be completely practical to make and really distinguished to look at."

SLUDGE GAS TURBINE

Although the method of sewage treatment at the London County Council's Northern Outfall Works at Beckton does not differ from that employed at many other works, the use of turbines running on a mixture of methane and carbon-dioxide gas derived from treated sludge as a primary power source is a major departure from usual practice. In addition to a normal continuous output of 1,860 kW, the power house, which was described with its associated equipment in last week's issue of the *Electrical Review*, gives a continuous flow of air to the diffused air plant for sewage activation and a continuous supply of heat to the sludge digestion tanks in which the gas is produced.

More than 2½ million cu ft of gas will be produced daily when the plant is in full operation later this year and it is expected that its use will result in a saving of some £500 worth of fuel oil per day. In a works of this nature the risk of plant failure must be reduced to the greatest possible degree and a large number of precautions have been incorporated in this installation. The use of methane gas has necessitated elaborate alarm and protection systems against fire and explosion, one of which is the injection of pyridine, which has a distinctive smell, into the gas main to give warning of any escape.

NUCLEAR FUTURE

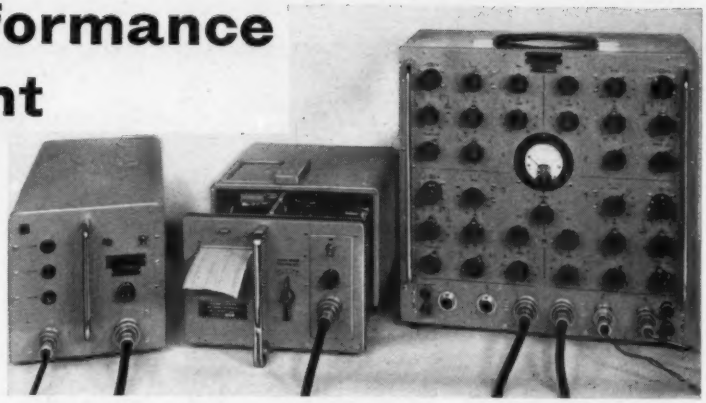
Speaking at a recent dinner of the Institute of Public Supplies, Sir Christopher Hinton, chairman of the Central Electricity Generating Board, said that when the present nuclear power programme came to an end he would be surprised if a further one was laid down. On the face of it this might mean that the building of nuclear power stations would end with the completion of those already in hand or projected. Of course it means nothing of the sort. Sir Christopher was merely suggesting that further nuclear development would not form the subject of a Government programme but would be left in the hands of the Generating Board as part of its normal duties.

ELECTRIC COOKERS

The next in our series of domestic electrical equipment surveys (6th November issue) will deal with electric cookers. Particulars will be given of type, size, oven loading and control, hotplates, special features and price of most models now on the market and many will be illustrated

Vehicle Performance Measurement

ELECTRONIC EQUIPMENT USED UNDER ROAD TEST CONDITIONS



By R. W. LENG*

The uses of electronic apparatus in general test-bed work and in the control of production processes are fairly widely known and appreciated. These uses normally involve the measurement of such quantities as pressure, temperature, speed and torque, under steady-state or dynamic conditions. This article deals with apparatus used for evaluating vehicle performance, with particular reference to measurements carried out under actual road test conditions, a requirement which introduces special problems in the design of test apparatus

THERE has always been a need for compact equipment of semi-portable nature for taking measurements in vehicles to produce information of value to the car designers. The measurement or recording of strains, vibration, movements, and forces in various components such as steering linkages, axles, and body members, often requires rather elaborate and bulky amplifying and metering equipment. This in turn raises problems in power supplies, using such devices as rotary convertors or vibrator units. Extra batteries and control systems add to the general problem, and upset test schedule specifications on weight distribution. Developments in transistors in recent years have played a major part in making possible the construction of amplifiers, oscillators, and other units small in physical size and suitable for operation from low-voltage supplies. In fact, it is usually possible to incorporate a small dry battery in the particular instrument, making it self-contained.

Strain Gauge Equipment

The electrical resistance strain gauge is probably one of the most versatile devices used in test instrumentation. The most common form consists of a fine wire grid bonded between layers of paper, with connections brought out to which external wires can be soldered. More recent types are made in various configurations by an etching process on metal foil with an insulating backing, similar to printed circuit techniques. When fixed with suitable adhesive to the object under test, the gauge is responsive to strain in the specimen, and changes of electrical resistance can be measured accurately by a Wheatstone bridge circuit. When used for stress investigations, the actual strain and stress must be calculated, using the manufacturer's gauge factor and the appropriate Young's Modulus and Poisson's Ratio for the material under test.

In practice, each " active " gauge is used in conjunction with a similar " dummy " gauge, mounted on a piece of unstrained material, to provide reasonably accurate initial balance of the bridge and also some degree of compensation for varying temperature. Sometimes, where both tensile and compressive strains are experienced simultaneously, two or all four arms of the electrical bridge can be active strain gauges, thus increasing sensitivity, improving temperature compensation, and dispensing with the dummy arrangements. Examples of this are beams subjected to bending loads and rings subjected to diametral deformation. Since the sensitivity of a strain gauge is mainly unidirectional along its own axis, it is usual to orient each gauge in line with the major principal strain axis. In cases where the directions of stress are not known, it is necessary to use rosette formations. This involves taking at least three strain measurements for each position, the gauges being placed at a known angle to one another, usually 45 or 60°. Separate gauges can be used, but composite gauges are available commercially.

Static strain measurement is easily accomplished by simple instrumentation, a typical system consisting of a stable d.c. supply, a sensitive galvanometer, a graduated slide wire potentiometer for taking measurements on the null-balance principle, and switching arrangements to connect the galvanometer to each gauge circuit in turn. Additional initial balance potentiometers are also provided for setting the electrical zero of each strain gauge circuit. Up to, say, 50 channels can be accommodated satisfactorily in this manner and this quantity is suitable for comprehensive stress analysis tests on components and structures subjected to static loads on a suitable rig.

In dynamic measurements, where waveform and phase relationships are important, the instruments are much more complex. In the laboratory, dynamic studies can be carried out with a direct coupled amplifier and cathode-

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Fig. 1 (above).—A four-channel strain recorder

Fig. 2.—Direct readings can be taken of hand and foot brake actuating forces

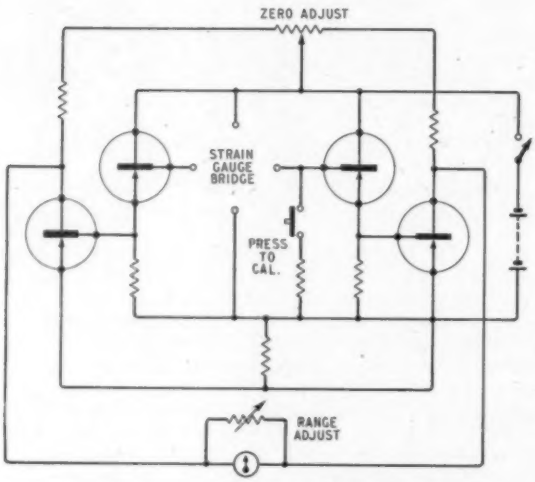


Fig. 3.—A strain gauge bridge galvanometer circuit

ray oscilloscope, but this system is not very suitable for mobile tests. The commercial four-channel strain recorder, illustrated in Fig. 1, can be carried conveniently on the rear seat of a car and supplied from batteries and a rotary convertor in the luggage boot.

This equipment operates on a modulated carrier system, each channel comprising a bridge circuit, into which the strain gauges are connected, an amplifier, a phase-sensitive demodulator circuit, and an output stage feeding the appropriate pen. The bridge supply to all channels is from a 2 kc/s oscillator, and balancing and calibrating facilities are built into each channel. The signal frequency response is from zero to approximately 80 c/s, a useful range for many tests on car suspension systems.

In addition to the recording of signals from resistance strain gauges, this equipment can be used with capacitance or balanced-inductance pick-ups, and is admirably suited to carrying out tests for assessment of car comfort and "ride" characteristics, using inductance accelerometers on seats, floor and axles.

For dynamic force measurement in steering links, axles and other components, the most convenient method is to fix strain gauges to the particular member and pre-calibrate the electrical output in terms of force. Actual recording in the tests can then be carried out with instruments of the type shown in the first illustration. A further development of this idea is to make special load measuring devices in the form of tubes, rings or beams, carrying strain gauges and pre-calibrated with appropriate instrumentation. Many such devices are available commercially, but it is often necessary to design specially to suit the particular application. Examples of this are dynamometers for measuring hand brake and pedal forces.

Direct reading instruments for use with these devices can be constructed using transistor circuits. One such instrument is shown in Fig. 2, and the circuit used is given in Fig. 3. The complete bridge circuit is contained in the load measuring unit and is energised from the 7·5 V battery in the instrument housing, the same battery supplying power to the transistors. Change in battery voltage is catered for by adjusting the meter scaling resistance while the calibrating button is pressed. This circuit has been found to be very stable and consistent in use.

Vehicle Speed Measurement

Speed is one of the basic quantities to be measured in many car tests and usually the car speedometer is inadequate. The main limitation of any device driven basically from the car wheels is that, with changes in load and speed, the effective rolling radii of the wheels do not remain constant, and thereby affect the accuracy of reading. The normal solution to this problem is to provide a separate wheel for speed measurement, but the design of a suitable fifth wheel in itself produces many difficulties. Most designs incorporate a fairly heavy wheel driving a tachometer-generator. The generator naturally imposes some mechanical drag, and this, together with the heavy wheel, necessitates cumbersome loading and damping arrangements to maintain road contact and prevent excessive bounce. In addition, unless tyre size is kept to the minimum, it will be subject to centrifugal growth and change of rolling radius as with a car wheel. Unfortunately, the various factors are cumulative in their effect.

A lightweight fifth wheel designed to overcome most of the difficulties mentioned above is shown in Fig. 4. It utilises a specially strengthened cycle wheel, vertically loaded by a rubber bush incorporated in the mounting. The wheel carries a slotted disc which generates electrical pulses by interrupting a beam of light in a photo-transistor pick-up unit. These pulses are fed to the instrument head containing a transistor circuit which is, in essence, a frequency meter. The actual circuit used is shown in Fig. 5 and consists of a limiting amplifier feeding a mono-stable multivibrator, which generates a rectangular current pulse for each input pulse. These current pulses are constant in height and width but vary in spacing with frequency; hence when passed through the meter, the integrated output gives a reading proportional to speed. The metering circuit requires a stable low-voltage supply and this is obtained from the car battery, using the pick-up bulb as a voltage dropping device in conjunction with a stabilising circuit.

The whole arrangement is readily adaptable for other applications. For example, the wheel disc can be changed for one with fewer slots for distance counting in fuel economy tests, or the metering circuit can be modified

to operate from ignition pulses to indicate engine speed. It is also possible to feed the electrical output into a rate measuring circuit for acceleration and deceleration tests.

Power Loss Measurement

It is obviously of great importance to know how much of the total power developed by the engine is actually utilised at the rear wheels. Theoretically, one would like to measure engine torque and speed simultaneously with output torque and speed at the contact of tyres and road. Unfortunately, engine torque is difficult to measure directly, and it is virtually impossible to measure output torque at the road surface. Indirect methods combining road tests with rig tests are sometimes adopted, and it is also possible to construct torque meters utilising strain gauges or inductance devices in the propeller shaft and rear wheels. Unfortunately, these instruments are sometimes erratic or inaccurate due mainly to difficulties encountered with slip-rings to transmit the signals from the moving parts.

A popular solution of the problem is to deduce the power requirements from results of a deceleration test. This consists of allowing the car to coast along a smooth level road and measuring the rate at which the speed drops from any chosen initial value. Then, knowing the effective mass of the vehicle, the drag force and power can be calculated. Theoretically, the results obtained are slightly less than the true values, since no account is taken of tyre drive losses or of the extra loss in the transmission when under power compared with coasting. Nevertheless, this method gives an accurate picture of the vehicle's drag characteristics.

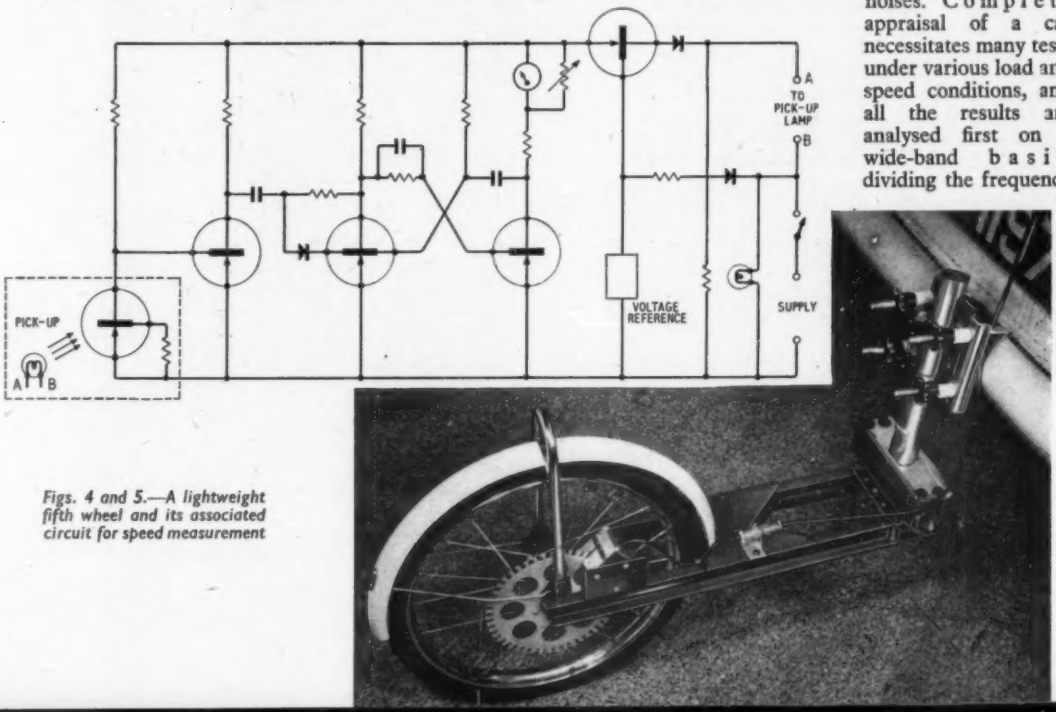
Fig. 6 illustrates an instrument which was specially developed for carrying out coasting deceleration tests. It consists essentially of a three-decade counter capable of measuring time by counting pulses from an internal oscillator, or distance by counting pulses from a four-lobe contact breaker on the car wheel. By using suitable gates and electronic relays, the circuit is arranged to give the time for two wheel revolutions, pause for 30 revolutions, reset to zero, then time a further two revolutions, and so on. Thus, it gives a series of readings representing speed, the readings being separated by a known interval. Since rolling radius enters into the calculations, it is necessary to do a preliminary test by driving the car at different speeds over a known distance, say ¼ mile, using the instrument to count wheel pulses. A graph can then be drawn showing effective radius against speed.

Fig. 6.—Deceleration tests are measured on this instrument

There is a constant struggle on the part of motor manufacturers to produce cars which are lighter, cheaper, better in performance, and yet quieter in operation. Obviously, some of the contributing factors are conflicting in nature. For example, the use of light-gauge metal and reduction of trim materials can increase vibration tendencies in panels. Because of the necessity for continuous investigation, measuring techniques are in a state of constant development.

In most investigations it is convenient to use a magnetic tape recorder in the car and to play back the results in the laboratory for analysis. A suitable tape recorder specification is naturally more stringent than that for a domestic recorder, particularly as regards frequency stability, and susceptibility to external acceleration and vibration. A twin-channel recorder is particularly useful in car work, to assist in locating particular sources of noise and to study phase relationships with vibrations. The provision of more than two channels, with the attendant complexity of apparatus, is not normally warranted. For noise recording, good quality omni-directional microphones are used, and for audio-frequency vibrations, crystal accelerometers are usually most convenient, provided that temperature effects are observed.

Analysis of noise recordings implies separation of the noises due to physical characteristics of the car from those produced by random sources such as tyre and wind noises. Complete appraisal of a car necessitates many tests under various load and speed conditions, and all the results are analysed first on a wide-band basis, dividing the frequency



Figs. 4 and 5.—A lightweight fifth wheel and its associated circuit for speed measurement

spectrum into bands one-third octave wide, and then narrow band (sharply tuned) analysis is used to pinpoint objectionable resonances.

The frequency analysis can be performed with separate filters but there are now several suitable comprehensive waveform analysers available commercially. Vibration measurements are, of course, dealt with similarly, except that in some cases the wide-band analysis is unnecessary. In a typical example of engine vibration analysis at a particular speed large vibrations were excited by the 4th and 6th engine orders, and this sort of observation can often be correlated with troublesome body vibrations at similar frequencies.

Road test results are supplemented by additional stationary tests using electromagnetic vibrators to excite the whole or parts of the car at various frequencies to study resonance effects. The information obtained often facilitates the location of potential sources of noise. A separate series of tests is necessary to assess the effectiveness of sound absorbing and vibration deadening materials. Some of this work can, of course, be done on the car, but it is often more economical to take preliminary measurements on vibrating bars and plates treated with the damping materials.

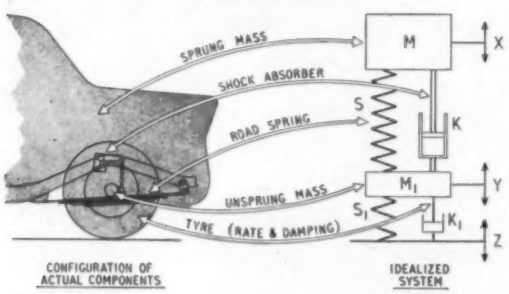
Computers

To take full advantage of the potentialities of computers in the design side of the motor industry, it is necessary that the engineers should orient their thoughts to suit computer possibilities, rather than vice versa. This is particularly true of digital computer applications. There are many problems which at present cannot be tackled in a truly analytical manner either because of the laborious nature of the calculations or of a lack of all the relevant information. The cost of a digital computer, together with the organising and training of a programming staff to prepare the problems, is prohibitive, and even hiring time on an external computer really requires a suitable programming staff to work in conjunction with the outside facilities. For these reasons, little use has been made to date of digital computers in car design work, and progress in realisation of potential is necessarily slow.

Analogue computers, on the other hand, offer themselves as very attractive design tools to assist the engineer in obtaining a better understanding of his problems and increase his store of information. In this respect they can be regarded as complementary to possible digital applications. The main attraction of the analogue computer is its use as an electronic working model of a mechanical system, i.e. a simulator, and it can be installed and incorporated into the design routine with minimum upheaval and almost immediate benefits.

The idea of constructing electrical analogues of mechanical systems is, of course, very old, but the modern computer achieves the desired result by an indirect method. The machine consists of a number of amplifiers which can be connected to perform functions of addition of two or more variables, sign reversing, and integration with respect to time. All quantities in the problem being studied are represented by voltages, and scale factors and coefficients can be set by suitable potentiometers. Special devices are required for performing functions such as limiting, squaring, multiplying and generation of a given curve. Examples are diodes fed with pre-set bias voltages, and servo-driven ganged potentiometers.

Fig. 7.—The actual and idealised components in a vehicle suspension system circuit



The following simple example illustrates how an analogue computer can be set up to study a car suspension system. Fig. 7 shows one corner of a car in its actual and idealised forms, and the equations defining its behaviour are derived by consideration of all forces acting on the two masses. Thus, with mass M, vertical accelerating force $M\frac{D^2X}{DT^2}$ is provided by the spring force $S(Y-X)$ plus the damping force $K.\left(\frac{DY}{DT}-\frac{DX}{DT}\right)$ where S is the spring rate and K is the damping coefficient. A similar equation applies to mass M_1, but includes the tyre rate and damping forces.

$$M_1\frac{D^2Y}{DT^2}=S_1(Z-Y)+K_1\left(\frac{DZ}{DT}-\frac{DY}{DT}\right)-S(Y-X)-K\left(\frac{DY}{DT}-\frac{DX}{DT}\right)$$

The sign convention is purely arbitrary, provided that correct relative directions are observed.

All the terms in these equations are represented by voltages in the computer and interconnections are arranged to satisfy the equations. Starting with the acceleration voltage, successive integration produces voltages representing velocity and displacement which, when modified by the appropriate coefficients, give the voltages representing forces. These are then added together and divided by the mass coefficient to produce the acceleration voltage which is fed back to the starting point. Then, if the electrical balance of the circuit is disturbed by an external signal, the various voltages will rise and fall in a manner identical with the behaviour of the mechanical system when excited by an external impulse.

The complete block diagram of the chosen example is given in Fig. 8 in which all the connections are labelled in accordance with the mechanical quantities which the voltages represent. It will be noticed that at many points the signs are reversed. This is because by nature, irrespective of function, all the amplifiers used in computers give an output which is anti-phase to the input, and this must be taken into account in compiling the circuit. Four function generators are shown for the rate and damping coefficients, since, in general, these are non-linear. The most suitable devices for this purpose are multi-segment diode function generators which consist of a series of biased diodes and associated amplifier, which can be set to give an output voltage approximating to any desired curve as a function of the input voltage. In practice, the function generators can be set up in either positive or negative sense so that, in the circuit of Fig. 8, the preceding sign reversing amplifiers are unnecessary, but they are included to make the circuit correct in general terms.

Once the circuit is set up, an input voltage can be fed in to represent bumps on the road, steps, ramps, or any desired function, and the engineer can readily adjust the values of masses, spring rates and so on, while observing the effects on an oscilloscope or pen recorder. It is there-

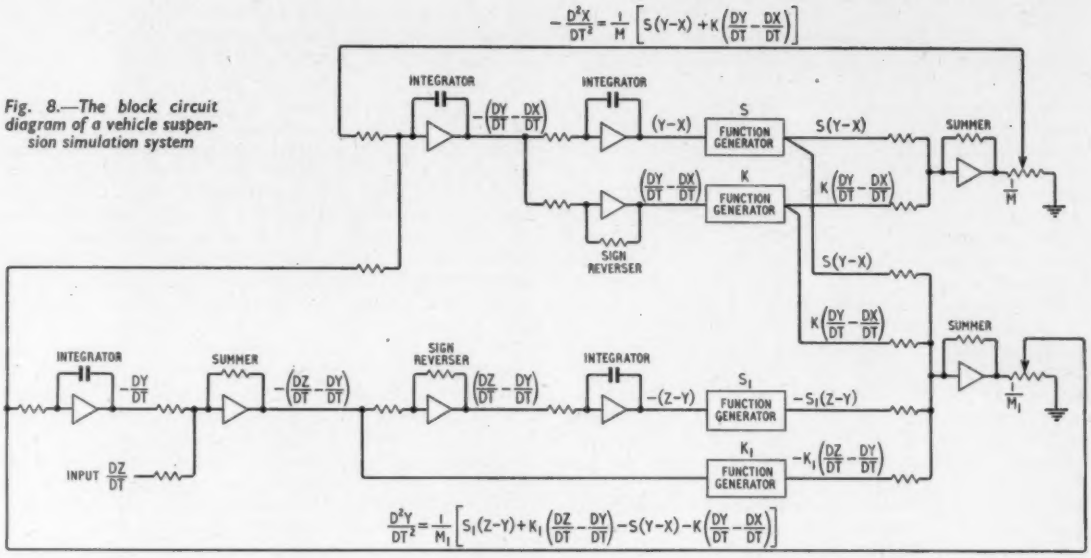


Fig. 8.—The block circuit diagram of a vehicle suspension simulation system

fore possible to optimise the design of the system for any given conditions, even before the car is built, and thus save considerable subsequent development time.

The above example is somewhat elementary, but serves to illustrate the principles involved. The use of analogue computers is naturally not restricted to this type of problem. It may be stated that any system for which the working equations can be written, can be simulated on an analogue computer. In the motor industry there are many other possible examples, such as the study of heat flow in engine cooling systems, car stability on cornering, and transmission vibrations.

ELECTRICAL ENGINEERING AND THE HEAVY CHEMICAL INDUSTRY

IN his address to the Utilisation Section of the Institution of Electrical Engineers on 15th October, the chairman, Mr. T. E. Houghton, took as his theme "The Electrical Engineer and the Heavy Chemical Industry." Electricity, he said, was first used in the industry for motive power and lighting, but it had become an essential service with the development of electro-chemical and electro-thermal processes. The annual consumption of the industry today exceeded 10,000 million kWh and was still increasing rapidly. Private generation accounted for some 31 per cent of the total requirements. Although abundant supplies were generally available from the public system, the case for private generation should always be investigated. If process steam at medium or low pressure was also required, a private generating station using back-pressure or pass-out turbo-alternators was generally an economic proposition, while if a relatively large station was to be erected the cost of installing condensing turbo-alternators was largely marginal, since such essential services as coal and ash handling plant had already been provided. The Thornton power station of I.C.I., Ltd., the most recent of this type, had an installed capacity of 39 MW and steam conditions of 1,600 p.s.i. and 1,060°F.

When the electrical load and process steam demand were balanced, electricity could be generated at an efficiency exceeding 80 per cent, and Mr. Houghton thought that there should be more collaboration between manufacturers requiring process steam and electricity and the public supply authority in providing a combined supply of heat and power from a public station where conditions were favourable.

Motor generators, rotary convertors and motor convertors had all been used to supply continuous electrolytic processes requiring direct current, the most successful being the large two-bearing, single-commutator motor convertor which had no heavy loss in low-voltage a.c. connections to reduce efficiency and no heavy-current slip rings and a.c. brushes requiring maintenance. Mercury arc rectifiers had also been used, though usually at higher d.c. voltages—700 to 750 V—and a 10,000 A, 260 V d.c. contact rectifier had been operating since 1952 with an overall availability, including maintenance, of over 96 per cent and a service efficiency averaging 96·7 per cent. Continuous running periods of over six months had been achieved and the contact life was 6,000 to 8,000 hr. Germanium and silicon semiconductor rectifiers had more recently been perfected and there was no doubt that this type would be preferred in future for electrolytic duty.

In dealing with the increasing demand for calcium carbide, for which three 20 MVA, three-phase arc furnaces were installed in a South Wales works, he spoke of the largest calcium carbide electric furnace so far built in this country, recently commissioned by I.C.I., Ltd. This was rated at 39 MVA and had an electrode current of 100 kA. To reduce reactance the connections between the transformers and the water-cooled electrode flexibles each consisted of sixteen 12in by $\frac{3}{8}$in copper bars, the lead and return circuits being interleaved, giving a reactance of some 2,100 $\mu\Omega$ per phase at 50 c/s.

Mr. Houghton went on to consider factory distribution, saying that continuity of supply was essential with so many continuous processes. Primary distribution was usually at 6 or 11 kV, though in certain cases a superimposed 33 kV ring supplied the secondary e.h.v. system

through local switching stations. Conveniently sited e.h.v. switching stations connected to the main supply point through reactors enabled the breaking capacity of the e.h.v. switchgear to be reduced to 150 MVA or less. From these switching stations radial transformer feeders supplied each substation. Local distribution was generally at 420 to 440 V and, since at this voltage the breaking capacity of the MV switchgear was limited to 30 MVA, not more than two 1,000 kVA transformers having an impedance of 5·5 to 6 per cent might be used in parallel. Lighting supplies were kept separate and fed at 220/125 V from three-phase transformers in the plant switching stations.

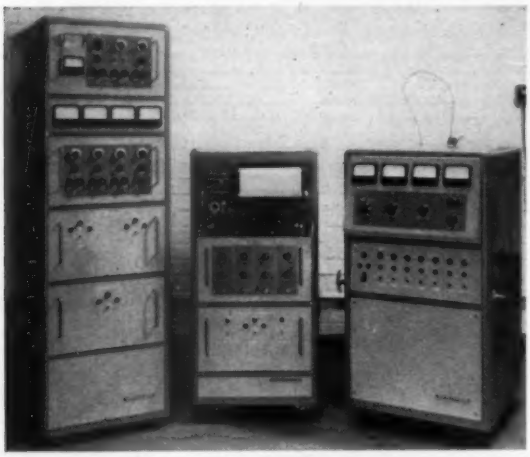
Where large electrolytic processes were supplied with up to 350 kA d.c., the heavy busbars required had to be carefully designed to prevent excessive voltage drop and losses. There were normally three or four sections, each supplied by a group of convertors and connected by power-operated circuit-breakers which had capacities not greater than 50 kA, as the section loads were normally balanced. At the economic current density in the bars of some 670 A/sq in, the temperature rise was normally small so that no provision had to be made to accommodate linear expansion. The equipment normally available to measure the heavy direct currents involved did not satisfy the stringent requirements of the process operators, and I.C.I.'s instrument department had produced a shunt having a low voltage drop, high accuracy and stability. The shunt consisted of resistance material having a negligible temperature coefficient welded into the requisite number of standard cross-section copper bars. With a precision thread recorder connected to the shunt through a suitable averaging box, the overall error had been reduced to ±0·33 per cent and at 50 kA there was only 350 W loss.

Many processes involved the use of inflammable gases or volatile liquids and, although suitable electrical equipment could be obtained for a variety of the classified risks, the type tests were carried out on a rather limited number of gases, often not including those for which the installation was to be designed, and Mr. Houghton regretted that the chemical industry had not so far established its own testing stations to provide reliable data for all the conditions likely to occur in practice. No equipment could be regarded as safe for three gases, hydrogen, acetylene and carbon disulphide, and in these circumstances it had either to be placed outside the plant or pressurised, using an inert gas such as nitrogen with provision for automatic shut-down in the event of gas pressure failure. Although a safe flameproof installation could be designed and constructed for most hazards, the limiting gaps between machine surfaces and similar clearances might increase rapidly in corrosive atmospheres, nullifying the protection provided originally and necessitating meticulous inspection and maintenance.

Finally, Mr. Houghton discussed the organisation of electrical staff, which in large concerns was under the control of an experienced engineer generally directly responsible to a director. In such departments the senior positions were held by experienced graduates, while similarly qualified men were appointed to the junior posts to provide for promotion.

RESPIRATORY MASS SPECTROMETER

DEVELOPED from an instrument designed by Dr. K. T. Fowler at the Post Graduate Medical School, London, with the aid of technical advice from the Metropolitan-Vickers Electrical Co., Ltd., the type MS4 respiratory mass spectrometer demonstrated by the company in London last week is capable of continuously analysing gas flow in a patient's breathing cycle. The instrument will have application in three main fields, measuring the function of small areas of the lung, sampling respiration at the lips in diagnosing such illnesses as bronchitis and in the mixing and analysing of gases in laboratories. Although developed primarily for medical applications, the instrument may also be employed on analysing such gases as propulsion rocket and diesel engine exhausts.



The control, recorder and power units constituting the type MS4 respiratory mass spectrometer

An analysis is performed by the separation of the molecules in the gas sample according to their molecular weights, achieved by bombarding the molecules with electrons to produce ions. These ions are accelerated in a high vacuum into a magnetic field which deflects them into circular paths and, since the deflection is greater for light than for heavy ions, the ion stream separates into separate beams of different molecular weight. A suitably placed slit allows a beam of a selected molecular weight to pass through to a collector electrode. As the accelerating voltage on the ion source is gradually reduced, controlled by the discharge of a condenser, beams of ions having successively greater mass pass through the slit. These fall on the collector electrode, causing minute currents which may be measured after amplification and indicating by their amplitude the number of ions in each beam. Thus, the proportion of molecules of different weight in the gas sample may be found and a complete analysis made, provided that all the constituent gases have a different molecular weight, as is generally the case in respiratory work.

The apparatus is housed in three mobile cubicles. The output unit contains the analyser tube and its associated pumping equipment and the electron beam supplies. The control unit incorporates all the necessary gear for operating the spectrometer direct from the mains supply. In the top chassis the main electrometer amplifier scanning unit and metering sub-chassis are mounted with a cathode ray tube, the trace on which shows the full mass range being scanned. Four meters indicate the amplitude of selected peaks in the mass range. The third unit contains a four-channel heated stylus recorder and four recorder amplifiers.

Water Heating in All-Electric Flats

Combination with Cold Storage for Food

By G. O. McLEAN

Considering the possible methods of providing hot water in blocks of flats, the author indicates that the use of a heat pump, which also caters for the preservation of food, is the most economical arrangement

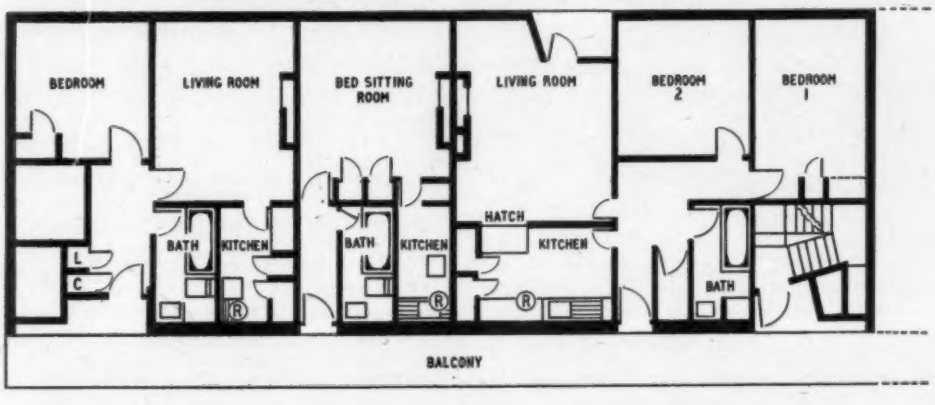
THERE is a trend by both local authorities and private builders to construct large blocks of flats in preference to semi-detached or terrace houses, giving vertical expansion rather than horizontal spreading. Electricity is, of course, not only essential for such domestic services as lighting, television and small power outlets, but is also ideal from the builders' and the users' points of view for all services in this type of domestic premises. The supply industry has been active in making this known to the local authorities and the architects who advise them, while articles in the technical Press have clearly indicated that planning engineers have been busy in their consideration of the types and economics of the distribution system involved.

A discussion at the recent E.D.A. Sales Conference was concerned with the problem of water heating in blocks of flats which had been specified as "all-electric." There did not appear to be unanimity about the choice between individual water heaters in each flat, with the control of use, and hence cost, being governed by the occupier of the flat, and a central installation which, through the use of storage cylinders, would enable energy at off-peak rates to be used but would be open to wasteful use by some flat occupiers if the cost of hot water was added to the weekly rent. As far as can be ascertained from the reports of the Conference, nobody put forward a third alternative which the author thinks worthy of consideration because of high load factor, additional amenity value and economics, a scheme comprising a central heat pump installation with individual cold cabinets in the kitchen of each flat.

Mention of heat pumps makes most people think of high capital costs, but each compressor type refrigeration machine is essentially a heat pump with the accent on the cold side of the cycle and dissipation or waste on the hot side. The phenomenal increase in refrigerator sales in the last six months is one proof that capital costs are not so high as to deter demand, and that hygienic preservation of food (and *not* keeping up with the Jones's) is the motive for the housewife's investment. This is especially true in flats, where food storage space is so cramped.

Despite the heavy burden of purchase tax (completely unjustified for a fuel-saving, food-saving, drudgery-removing home necessity) the small dual-purpose "packaged" heat pump unit giving water heating and larder cooling has fulfilled the claims made for it by the pioneers in the E.R.A. committee who did the original experi-

Typical flat layout showing—R—suitable position for built-in cold locker



Prestcold built-in 3 cu ft cold locker

mental work, and the two manufacturers who put commercial models on the market. Early teething troubles due to "unbalance" between the "cold" and "hot" halves of the cycle were soon overcome by the addition of simple and often automatic heat leaks; and the use of hermetically sealed compressors, wholly or partially immersed in a heat transfer fluid, from the outset has shown that maintenance problems are very few indeed and that performance ratios are well over 2·5 even under bad operating temperature conditions. This means, of course, that the housewife pays less than half an immersion heater's running costs for the same quantity of hot water.

Although a prototype domestic unit heater was shown at the Building Exhibition at Olympia in the winter of 1953, and the first commercial model was on the market the following year, the whole idea must be considered to be still in its infancy, and buyers of high-priced domestic appliances do want something that has been well tried over the last ten years. This criterion is fulfilled by multi-point refrigeration systems and also central hot water systems.

American Practice

Just as flat dwelling in America has preceded the vogue in this country by some twenty or thirty years, so the climate there made cold locker food storage a more pressing necessity. As is well known, many large blocks of flats have a central refrigeration plant with a cold locker reserved for each apartment. There have been many descriptive and technical articles on these installations, and such refrigeration handbooks as Audels quote figures of 1½ tons of refrigeration being suitable for 250 lockers having 4 cu ft of space each and costing approximately $40 (£14) per locker for the complete installation, of which the refrigeration machinery by itself costs $25 per locker. Not much space need be devoted to establishing the credentials of a central hot water system as every hotel in the country is dependent on this and the steps from an old coal-fired boiler to the modern automatically controlled oil-fired boiler and on to a large heat exchanger as part of the heat pump installation are not large. Thus, two necessities of the flat dweller, namely, cold storage for food and hot water for washing have been made by well-tried systems with separate identities. There is no technical reason against, but a very good economical incentive for combining the systems, and this is just what a heat pump installation would achieve.

Suggested Scheme and Costs

The water heating requirements for a small block of two flats per floor and four floors high would be about 320 gal per day, equivalent to 16,000 B.Th.U/hr for twenty hours per day. This would be supplied easily by a 2 h.p. compressor with its condenser in a 120 gal storage tank. Each flat would be fitted with an insulated 3 cu ft cupboard, similar to the Prestcold model illustrated, either wall mounted or at ground level, and containing a simple plain tube evaporator with a manually adjustable expansion valve, so that each flat dweller can regulate the locker temperature, including defrosting, as required.

Because of unbalance in the winter, when probably only 8,000 to 10,000 B.Th.U./hr can be expected from the lockers, an extra evaporator in the basement or external, will be required. Allowing for this and the liquid and gas lines between basement and individual flats—but excluding the hot and cold water plumbing, which would be common to all systems—the net capital costs would be about £400, or £50 per flat. The running costs for energy only would be the price of 3 or 4 kWh per day, or 5d/6d per flat.

When one considers a larger block of flats, say, eight floors with one large and two small flats on each half-floor, then the capital cost drops to about £35 per flat because of the diversity in the demands for hot water, and the lower prices per horsepower or B.Th.U./hr for the central equipment. For an even larger block of, say, forty flats there is a further drop in costs to about £27 per flat. The running costs, which are related principally to the hot water draw-off, are probably unchanged at 5d/6d per day, per flat.

In the layout diagram the positions of the built-in cold lockers in the kitchens of three sizes of flats in a block of sixty flats are shown. The run of refrigerant pipes would be as easy as the hot and cold water pipes to the kitchen sinks—adjacent in each case—with rising mains in the centre stair well, terminating in the compressor and heat exchanger room in the basement, which already houses such services as laundries, transformer and switch rooms, refuse tip, etc.

Surely, the scheme outlined above is worth encouragement. For the supply authority, it is lightly loaded with a load factor of approximately 80 per cent; for the owner of the property, the flats should be in great demand because of the cold locker, plus abundant hot water; while for the occupier, the two amenities are obtained at a low running cost.

Thermonuclear Research Establishment

THE United Kingdom Atomic Energy Authority are seeking the necessary approvals to acquire and develop a site of some 175 acres within the perimeter of the Royal Naval Airfield at Culham, Oxfordshire, for development as a new research establishment. This establishment would be for research into controlled thermonuclear reactions and plasma physics and the study of nuclear fusion as a possible source of industrial power. Most of the thermonuclear research now carried on at Harwell and Aldermaston will be moved to the new establishment.

One of the immediate tasks at the new site, if approved, would be the construction of I.C.S.E. (intermediate current stability experiments), a large machine which will incorporate the results of experience with ZETA and of other studies in this field, both at home and abroad. It is planned that the total number employed at the proposed establishment will rise to 1,000 within four or five years.

Atmospheric Pollution

MEASUREMENT AND PREVENTION

PRELIMINARY particulars of the International Clean Air Conference held in London on 20th, 21st and 23rd October appeared in the *Electrical Review* of 16th October. Papers scheduled for discussion included a number of direct or indirect electrical concern. In a survey of relevant legislation and administration in Great Britain Mr. P. D. Coates (Ministry of Housing and Local Government) pointed out that the Clean Air Act of 1956, in addition to strengthening existing provisions of local authorities for dealing with industrial sources of nuisance (not covered by the Alkali Act), enabled them for the first time to prohibit the emission of smoke from domestic premises. No discharge from industrial chimneys of dark smoke (Ringelman shade No. 2) would be allowed after 1963 except for very short periods necessary in routine operation.

Education of public opinion, whether among those concerned with technical or administrative aspects or among the mass of the population, was dealt with by Mr. Arnold Marsh (director, National Society for Clean Air), who stressed the need for high-class publicity to cover a limited field if the financial resources available were insufficient to do more.

Sulphur Content of Fuel

Population growth (1½ per cent per annum) and industrial expansion were said by Mr. G. H. Daniel (Ministry of Power) to be increasing world energy requirements by over 5 per cent per annum, but fuel was deteriorating and also had a rising sulphur content in both coal and oil. For British coal the sulphur percentage had gone up from 1½ to 1¾ in the last two decades. Mid-East residual oil, as used in furnaces, normally contained about 3 to 4 per cent of sulphur, which could not at present be economically reduced at source. A mitigating circumstance was the increase in the size of individual plants which allowed the economical installation of efficient grit arrestors and dust precipitators and made less difficult the removal from flue gases of sulphur, the demand for which was rising. Another favourable feature was the tendency to use refined fuels by the ultimate consumer. According to Dr. J. Bronowski (National Coal Board) heating and lighting together accounted for only 5½ per cent, the smallest single item in the cost of living index.

Three papers were presented by members of the staff of the Central Electricity Generating Board. Messrs. W. G. Cummings and M. W. Redfearn showed that instruments developed at the Central Electricity Research Laboratories made possible a realistic assessment of the contribution of a power station to the total sulphur-dioxide pollution in a particular area and the efficiency of the dispersion of plumes from stacks under varying meteorological conditions. These instruments comprised an automatic SO_2 recorder and a portable meter giving continuous readings in the range of 0 to 50 parts per 100 million SO_2 with a sensitivity of one part of SO_2 in 100 million parts of air; 25 instruments were now in use near power stations and additional equipment was available for studying dispersion of plumes, including telemeters in radio connection with a central point. The high stacks of modern power stations had been found to disperse hot gases so effectively that maximum short-period SO_2 concentrations at ground level near power stations rarely exceeded 30 p.p.h.m. (i.e. less than the *mean* value for large towns); the mean value near power stations was very much less, in one instance being below 5 p.p.h.m. over two years.

In the second paper of the series Mr. D. H. Lucas described a method of calculating the quantity of pollution caused by domestic fires, which were generally agreed to be responsible for the major emissions. Assuming an average chimney height of 30ft the SO_2 concentration was inversely proportional to wind speeds above 5ft/sec. The relationship between coal consumption and the number of houses or the number of people per unit area was fairly accurately known so that an estimate of sulphur concentration could be made from knowledge of any of these factors. Measurements were usually based on monthly average concentrations as estimated by the standard sulphur candle converted from mg/100 cm^2/day to 100 million of SO by multiplying the result by 2·5. Correction for wind strength could be made from known long-period averages, which could be applied to a single month without undue inaccuracy. A representative maximum value of concentration could generally be conveniently taken as that for the leeward half of a city. The following basic data were applicable to the calculations of air pollution from domestic premises on cold winter days (16 hours per day): emission of SO_2, $1{\cdot}7\times10^{-8}$ ft^3/ft^2 sec; emission of smoke, $3{\cdot}1\times10^{-9}$ lb/ft^2sec; coal consumption, 3·7 lb/hr/10,000ft^2; population density, four per 10,000ft^2; houses, one per 10,000ft^2.

In the third paper from the C.E. Research Laboratories Mr. G. Spurr demonstrated from recent examples that the heat rate required in a chimney plume to ensure penetration of any inversion of known height and intensity could be calculated. High chimneys were essential and the final temperature of the plume must be greater than that of the environment at the tip of the inversion. A chimney serving 100 MW of plant or more would penetrate the worst inversion. More knowledge of the

Mr. C. T. Melling, member of the Electricity Council; Mr. T. E. Daniel, chairman of the Electrical Development Association and chairman of the North Western Electricity Board; and Mr. J. I. Bernard, director and secretary, E.D.A., at the Clean Air Exhibition

frequency of inversion was required, but the B.B.C. television mast at Crystal Palace would be used to record continuously the temperature profile of the lowest 1,000ft of the atmosphere. Records from Cardington showed that the majority of inversions extended from the general surface to between 750 and 1,000ft.

Mr. P. J. Meade (Meteorological Office) emphasised the importance of taking into account the position and depth of an inversion layer in relation to the varying heights of chimneys and consequently the buoyancy of their effluents, although the atmospheric nature of occasional inversions might still defeat the advantage of buoyancy. The uses of photography in air pollution observations and investigations was discussed by Dr. R. S. Scorer (Imperial College, London) who illustrated by examples the values, limitations and possibilities of error associated with such work.

A new electrostatic-precipitator instrument devised by the British Thomson-Houston Co. for monitoring flue dust surface area was described by Dr. D. H. Grindell of the company's research laboratory. The author submitted that the harmful air pollution characteristics of flue dust were governed mainly by the size range of the particles (0·1 to 1 micron in diameter), rather than by their opacity and gross weight. In the precipitator section an earthed metal tube surrounded a thin axial wire which was subjected to a high voltage. The resulting corona discharge caused each dust particle to acquire an electric charge approximately proportional to the square of its radius and to be attracted to the outer tube. In the monitor the velocity of the dust stream and the length of the corona wire were adjusted to ensure that precipitation occurred in a separate collecting section, having the outer cylinder connected to an amplifier and with a long central corona-free electrode charged to the same polarity as the dust. The flow of charged dust particles to the outer tube constituted a current proportional to the total external surface area of the dust sampled by the monitor per second. Experimental equipment had been in successful operation for some months at the outlet of the dust arrestor of a C.E.G.B. power station using pulverised fuel, and prototype models would shortly be on trial at stations with different boiler characteristics.

Electrical features of the exhibition, which was arranged in connection with the Conference, included devices applied by the Central Electricity Generating Board to the study and control of power station chimney emissions, one of which was a balloon used in plume tracking. The Chemical Construction (G.B.) Co., Ltd., showed for the first time a new method of removing SO_2 from stack gases by the addition of ammonia gas to form ammonium-sulphur salts which were removable in an electrostatic precipitator. Prominence was given by the Electrical Development Association to electric underfloor heating in new buildings, having special regard to low installation costs and to efficiency and economy in operation.

The General Electric Co. exhibited space-heating equipment in the shape of a 1 kW low-level "Nightstor" storage heater, 1½ and 3 kW twin-zone radiant types adjustable for either localised or dispersed heating (shown for the first time) and a new 10 kW low-level fan heater. For central heating systems there were recently introduced hot water circulators and water storage heaters. Other industrial equipment included a smoke density recorder based on variations in luminous intensity measured by a photo-electric cell and amplifier.

A selection of boiler efficiency and automatic control instruments was displayed by James Gordon & Co., Ltd. Electronic control equipment shown by Lancashire Dynamo Electric Products, Ltd., included a smoke "densitometer" and alarms carrying the B.S.I. "Kite Mark" indicating compliance with B.S. 2740:1956. Uses of the electrostatic precipitation principle were illustrated on the stands of Lodge Cottrell, Ltd., Simon-Carves, Ltd., and the Sturtevant Engineering Co., Ltd.

NEW DATA PROCESSING SYSTEM

A NEW data processing system which is believed to be the most comprehensive and up-to-date equipment of its type available anywhere in the world has just been put on the market by the English Electric Co., Ltd. Known as the KDP10 data processing system, it is capable of handling such normal problems as market research and forecasting, inventory and production control, cost accounting, pay rolls, sales and cost invoices, and such wider matters as statistical surveys and census studies. The machine is to be built at the company's Kidsgrove works and is based on a design by the Radio Corporation of America, modified to suit manufacturing techniques and operational requirements in the United Kingdom and Europe.

The KDP10 is fully transistorised, is capable of handling alpha-numeric data and employs magnetic tape, punched paper tape and punched card input/output as well as printed output. These facilities allow the system to be integrated with any existing mechanised office and, by the use of magnetic tape, provide for the daily scrutiny and up-dating of records and files in organisations handling masses of detailed information. The magnetic core storage is expandable within the range 16,000-260,000 characters and information can be transferred to and from the magnetic tape storage at very high speed. The system can record and transfer information on tape at 33,333 characters per second in the quantity required—unlike the conventional systems which provide for standard lengths of tape whatever the amount recorded. There is a fully comprehensive automatic checking system which virtually eliminates chances of error in the input and output of information and ensures the accuracy of arithmetical calculations.

The advantages of the use of transistors, printed circuits and miniature components are well known; in the case of KDP10 they are particularly marked in relation to the saving of actual unit costs and of the provisions that need to be made for power, ventilation, floor space and maintenance.

The complete system consists of a number of integrated units covering high speed store, programme control unit, tape selection and buffer unit and a console with associated monitor printers and paper tape punch, a paper tape reader and high speed printers. The system is readily adaptable to meet the requirements of both small and large organisations; for a smaller concern, wishing to allow for future growth, KDP10 can be built up, unit by unit, in proportion to the volume of work demanded of it without altering the basic installation.

Atomic Energy Exhibition

AN exhibition on Britain's nuclear power programme and the uses of radioisotopes in industry, medicine and research, presented by the U.K.A.E.A., will shortly visit a number of provincial cities, opening first at Sheffield on 6th November for nine days. Other cities to be visited in the near future, where arrangements have already been made for the exhibition's presentation, are Bradford and Bristol.

VIEWS on the NEWS

By REFLECTOR

I MUST confess to a certain sympathy with Mr. J. E. Morpurgo who has written to the *Daily Telegraph* on the siting of nuclear power stations. He has had correspondence with the Central Electricity Generating Board on the subject. Asked if the stations were safe the Board replied that they were as safe as any industrial plant. Then, Mr. Morpurgo asked, "Why ruin a lovely and peaceful area," and the answer was "For reason of safety." The next question was why, if the dangers were negligible, the stations were not built in an already industrial area. The Board replied that there must not be too many people living close by, which again started the circle "Is the power station safe?" and so on. Mr. Morpurgo admits that he is the owner of a beautiful old house at Bradwell and wants to sell it, but that his prospects are affected by the nuclear power station going up in the area. Although he blames the C.E.G.B. his complaints should surely be lodged with the Government which is really responsible for the siting policy being followed by the Board.

* * *

This last point was made in a subsequent letter by Mr. Tom Driberg who, however, said that the decision was a precaution against the possibilities of a nuclear war. Actually the policy was based on possible danger from the stations themselves. Mr. Driberg did not think that Mr. Morpurgo's property should be depreciated in value by the presence of the Bradwell nuclear power station. Indeed, it was quite possible that its value would be raised by the need for accommodation for the staff.

* * *

Manufacturers' guarantees form the subject of an article in the latest issue of the *Shopper's Guide* (published by the Consumer Advisory Council of the B.S.I.). It is alleged that some manufacturers insert clauses in their guarantees which deprive the purchaser of his right to claim compensation for damage caused by defects for which the firm itself is responsible. The Council advises buyers to delete such clauses when filling in the guarantee forms. It says that the firm concerned may refuse to accept this but a series of such "pin-prick" attacks may ultimately induce firms to alter the terms of their guarantees. I am glad to note that one concern which has cut out the offending clause from its guarantees is one of the leading domestic electrical appliance manufacturers.

* * *

During a recent visit to Yorkshire I stayed with friends and in discussing the merits and demerits of certain domestic electrical equipment a number of interesting points were raised. Having recently converted from gas to electric cooking my hostess was able to make authoritative comparison between the two forms and was of the opinion that supporters of gas cooking were at least in part persuaded that this medium was quicker by the noise produced and in this respect electricity does seem to be at a "psychological" disadvantage. Certainly it might form a more acceptable argument for advocates of electric cooking to use when visiting gas equipped homes than to suggest that the food offered had been cooked in a poisoned atmosphere. Two other points which were brought up and which might merit manufacturers' attention were the need for electric kettles to have a secondary smaller element just to maintain the water at boiling point, and table or floor standard lamps with some form of control to give the desired illumination for reading or for such combined activities as knitting and television viewing.

* * *

Dealing with the subject of smokeless coal, the *Guardian* remarks:—

> "If coal is to hold its own as Britain's major domestic fuel, clean, smokeless briquettes must be turned out in millions of tons, and at a price which must compete not only with the direct cost of oil, but must be sufficiently attractive to offset the labour-saving advantages of oil."

Surely it would be to the greater advantage of the National Coal Board and to the domestic consumer to encourage the sale of coal-generated electricity with its greater labour-saving advantages and cleanliness.

* * *

Space is a very important consideration in industrial establishments and so equipment is required to be as small and compact as is reasonably possible. This reduction in size often restricts accessibility—another important requirement—and that is no doubt why a firm of electronic apparatus makers was advertising in *The Times* last week for "sub-miniature engineers."

* * *

Seventy years ago the *Electrical Review* (1st November, 1889) welcomed the establishment of the Electrical Trades Union as likely to be of benefit both to electricians and their employers. It was thought, however, that there was one possible "disagreeable result."

> "Where the wages are uniform the tendency will always be for the employer to take the best man available, and the weaker must consequently tend to 'go to the wall'; but where the wage is according to the skill of the employé, it is not necessarily so, as an inferior hand (whether his inferiority results from mental or physical weakness matters not) may get work at less wages than his stronger confrère; yet he still gets work."

Today, of course, the converse seems to be the case: the "weaker" worker has to be treated on the same footing as the better one; it is not easy for the employer to encourage skill and merit without laying up trouble for himself. Nevertheless, the *Review* concluded its comment by saying that

> "The movement seems strongly supported, and we trust that it will be guided wisely and well to the benefit and prosperity of the whole industry."

INTERNATIONAL FILM CONGRESS

Some Electrical Productions Seen at Oxford

By ALEC M. HUGHES

ONE film to secure a Diploma of Merit at the recent XIIIth Congress of the International Scientific Film Association at Oxford was the Czechoslovak film " On Shining Traces." This was a popular account of the principles and study of electrical discharges, and their practical applications—a film notable for its beauty of colour photography and a pictorial composition which could entertain with vision alone.

This film was typical of the more imaginative approaches to popular science film making, which in a subject like electricity faces many challenges. " The Synchrotron," an Italian film, was another Diploma winner. This attempted a popular exposition of a very advanced modern technique which reveals nothing visual for the film maker to use apart from the equipment itself. In this instance the problem was ingeniously overcome by superimposing clever animation on well-illuminated studies of parts of the equipment itself. One particularly successful device was a shot of part of the curved interior of the synchrotron, the flow of electrons being illustrated by tiny streaks which seemed to appear from over one's shoulder with an almost " 3-D " effect.

Nuclear energy formed the subject of other films, such as the Belgian " Nuclea," which discussed some of the research at Mol on the peaceful uses of atomic energy; the Czech film " Radiation and Life," discussing another aspect of the problem which exercises the minds of many today—the possible dangers of increasing radioactivity in the atmosphere; and the Soviet film " The Atom Helps Us " showing the use of radioactive isotopes for increasing crop yields.

Railway Electrification

If many aspects of electricity are poor basic material for the film maker because there is nothing to be seen of their processes, he can find his compensation in the erection or installation of much of the equipment. Not all film makers do so to such good effect as those who made " 25,000 Volts " a French film record of the electrification of the Calais-Basle railway line. One recalled the B. I. Callender's Cables film shown at Harrogate last April (" On the Track of Efficiency ") which dealt with exactly the same theme in a British context. But there was a great difference in treatment. The French one was a film student's delight—beautiful photography, specially composed music, and the imaginative use of live sound to build up a fascinating picture of the complexities of the operation, the difficulty of carrying out a major installation during normal line working, the pressure of work round the clock in every type of weather and terrain, and the skill of the workers themselves.

Other aspects of the world of electricity were to be found in the British film " Photo-Emission," an instructional film using superimposed animation to give an account of a difficult subject which requires an element of motion for adequate exposition. Past masters at instructional material are the East Germans, and DEFA studios again this year had a fine display of educational films. One of these was devoted to resistance welding. The second part of this dealt with " Dip-Upset Welding," illustrating clearly the three phases of the process —preheating, burning off, and fusion. Another East German film was concerned with semiconductors — a beautiful black and white record of the extraction of germanium from various ores and examples of its use in a wide variety of equipment—in radio and public address equipment; for generating electricity from the heat of a paraffin lamp to work a radio set; in photo-electric devices for fire alarms or to work the doors of a fire station; and in earth satellites.

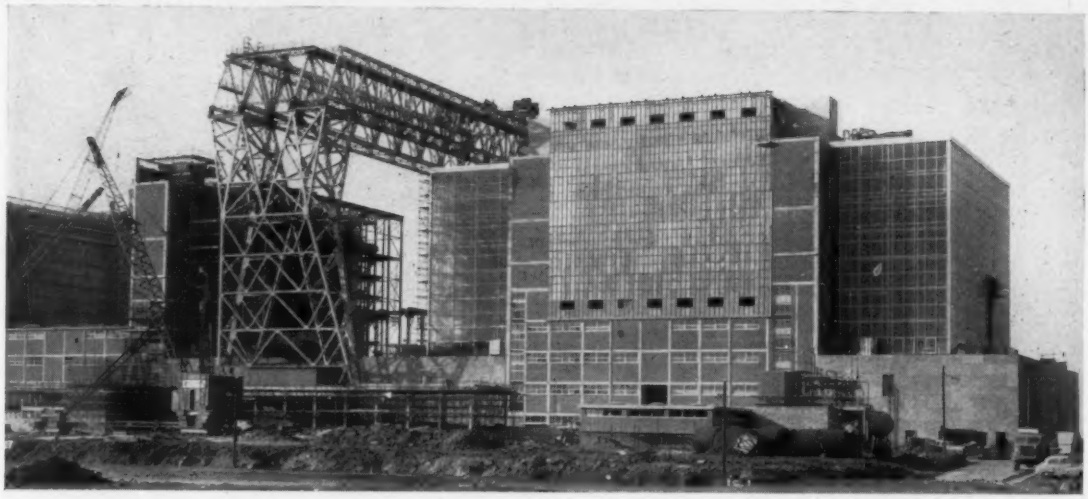
Power Station Construction

Concerned with electricity, but devoted to the civil engineering problems in constructing Sweden's largest power station, " Stornorrfors " rather disappointingly did not collect an award. This was a remarkable piece of film making — with some magnificent colour shots of multiple drilling operations, of some ingenious machinery such as a large and very mobile crane, of time-saving techniques such as the insertion of hundreds of drill guides, so that drilling could be carried on with whole batteries of remotely-controlled drills.

The Hungarians had a film on the principles of television; and another on corrosion, explaining its origins as a fractional electrical discharge, showing some of its ravages, indicating the causes—such as induced current from tram cables affecting street mains—and showing safeguards such as rust inhibitors. British Transport had " Under the River " with its effective account of the construction of the Severn tunnel and its valediction to the steam pumps shortly to be replaced by new electrical equipment. Morocco had entered " Ionosphere Seismology "—a short study of the formation of radio waves and a résumé of the theories and discoveries related to them. The Poles had two films concerned with light polarisation.

Industrial Use of Films

These were but a few of nearly 190 films from twenty-one countries which were screened at the Congress. They showed that the use of film for both popular presentation and research is on the increase. Thus, John Hadland could report that whereas four years ago the fifty or so high-speed cameras in use in Britain were nearly all engaged on some aspect of weapon research, today as many more again were being used by industry. Most of these were cameras of a type which photographed at anything from 300 to 30,000 pictures a second. But in the West we had got up to four million pictures a second and the Russians had even achieved five million. Unfortunately, the film they were to show taken with this camera did not arrive. As Hadland said, here was a branch of technology which in but a few years seemed to have reached its limit of development, because in photographing at such speeds a single picture was exposed in the time that it took light to travel but one foot, ten inches. So there was little moving at speeds high enough to make new developments worth while.



The Goliath crane and No. 1 reactor building

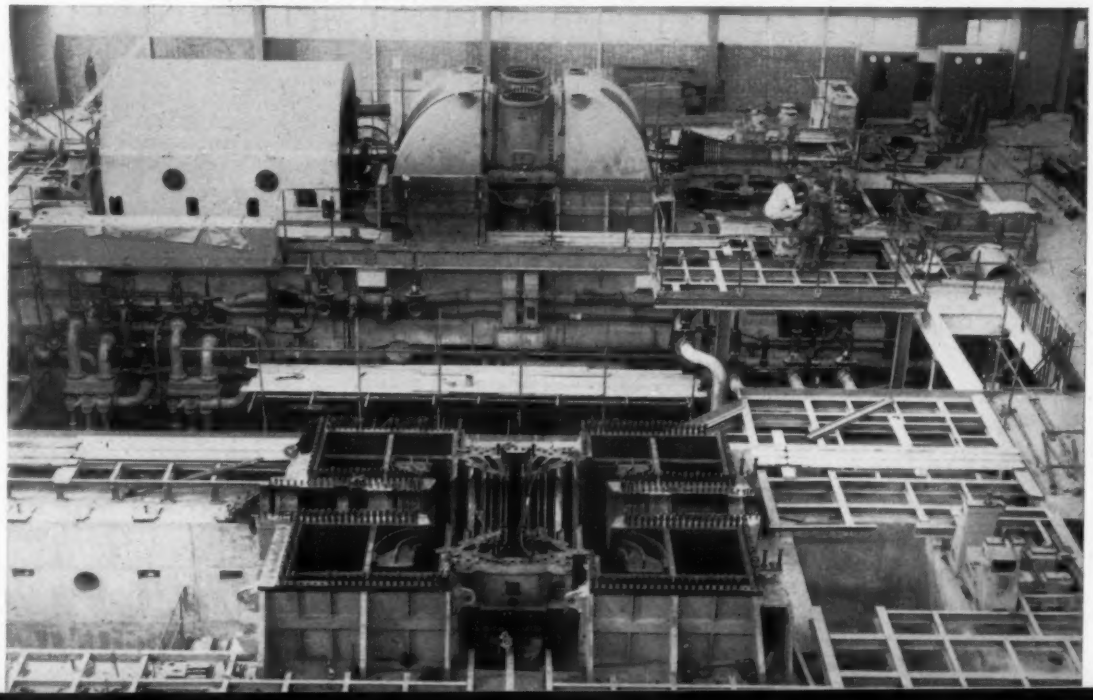
PROGRESS AT BRADWELL

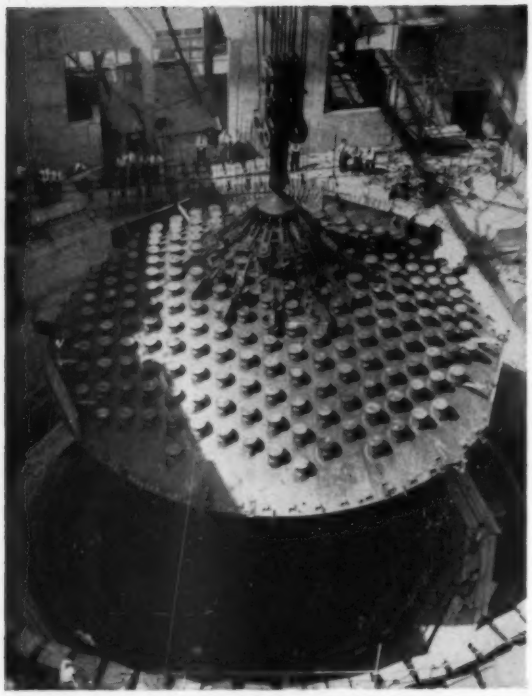
Final Heat Exchanger on Site

LAST week the twelfth and last of the 200 ton 92ft long and 20ft diameter heat exchanger shells was finally transported to the nuclear power station site at Bradwell to be lifted into position by the Goliath crane following its 297-mile sea journey from the Thornaby-on-Tees works of Head Wrightson & Co., Ltd. The station, which is being constructed by the Nuclear Power Plant Co., Ltd., on the south bank of the Blackwater estuary some nine miles from Maldon, will, when completed, have a guaranteed net output of 300 MW. The plant will consist of two natural uranium carbon-dioxide, gas-cooled, graphite-moderated reactors supplying heat to 12 boilers, installed in two groups of three on opposite sides of each reactor. The six main 52 MW turbo-alternators will be supplied with steam at 700°F and pressures of 745 p.s.i. and 195 p.s.i. Three auxiliary 15·2 MW turbo-alternators will supply power to the gas circulation blowers.

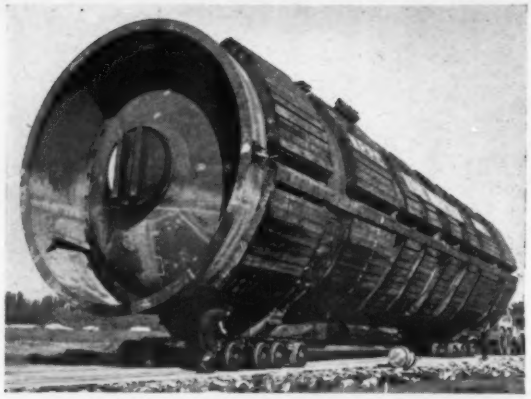
The building for No. 1 reactor is nearing completion. The spherical pressure vessel has been stress relieved and is due for its pressure test shortly, following which the standpipes for reactor charge and control will be installed, and clean conditions will be established within the vessel for the laying of the graphite core. Above

Erecting the first two turbo-alternators





Installing the top dome of No. 1 reactor pressure vessel



A heat exchanger on the final stages of its journey to site

the vessel, in the area known as the pile cap, the gantry for the charge/discharge machine has been positioned on its rails ready for the arrival of the two charge machines. The pile cap crane has been installed. At each end of the reactor are three boilers, five are fully tubed and the sixth almost complete. Below each set of boilers, at ground level, is a blower house and five of the six blowers have passed their "Phase 1" or running test. In the reactor control rooms, the burst slug detection equipment and upper control rod gear are installed.

In the early part of November, the top cap of the pressure vessel for No. 2 reactor will be lifted into position and welded, and this will be followed by the thermal dome. Five of the six boilers have been installed and are being tubed. The turbine house is structurally complete. In the main hall the first turbine is finished and the second one is awaiting the arrival of its l.p. spindle. Three main and one dump condensers have been installed. In the auxiliary turbine house, the first condenser has been placed and is being tubed. The diesel house, battery room and water treatment plant are finished, and the circulating water system, comprising a pumphouse, distribution and return systems and an offshore barrier wall with inlet and outlet coffer dams in the estuary is nearing completion. The switchyard is receiving incoming electricity for station requirements, and the administration block and canteen building have been handed over to the C.E.G.B.

NATIONAL INSPECTION COUNCIL

PROGRESS TO DATE

THE annual general meeting of the National Inspection Council for Electrical Installation Contracting is to be held at the Connaught Rooms, London, W.C.2, on Friday, 13th November (noon). It will be followed by an informal discussion and luncheon at which Sir John Pickles, chairman of the South of Scotland Electricity Board, will be the guest-speaker.

Progress Report No. 10 prepared by the N.I.C. covers the period 31st July to 30th September. It notes with regret the resignation from the N.I.C. of Mr. C. R. King in consequence of his appointment as chairman of the Electricity Council. That Council's representative is now Mr. C. T. Melling.

The method of implementing the decision of the National Inspection Board to give the Scottish Committee direct representation has been decided upon and will form the subject of a resolution at the annual meeting. In order to improve the Council's revenue to some extent the scale of fees charged to approved contractors has been revised.

During the period covered by the report 50 applications for enrolment were received; 56 applications were approved by the Board; 60 were deferred for further inspection; six applications were rejected; and 24 firms were removed from the Roll, mainly because they had gone out of business or had given up installation work. There were 106 inspections of the work of applicants, including those carried out on work by "deferred" applicants.

As a result of reports from the Council's inspecting engineers the Cable Makers' Association issued a report regarding the precautions to be observed in the installation of p.v.c. sheathed wiring systems to guard against corrosion by creosote.

On the subject of publicity the report mentions that a number of advertisements have been inserted in their local papers by approved contractors drawing attention to the need for sound installation work and proclaiming that they are on the Roll of Approved Contractors. A regional meeting was held in Manchester on 13th October and others have been arranged as follows:—Leeds, 10th December; Cardiff, 26th January; and Middlesbrough, 9th March. The Council expresses its thanks to the Electricity Boards who have publicised its work at various exhibitions and shows.

International Motor Show

SOME ELECTRICAL ASPECTS

ALTHOUGH primarily intended to display the latest products of the world's car manufacturing industries, a number of items of electrical interest are being shown by the 500 exhibitors at this year's International Motor Show at Earls Court, London (21st to 31st October). These are mostly on the gallery stands where car accessories and equipment for the motor trade itself are shown, though a number of vehicles incorporate interesting electrical features.

The majority of the cars displayed have a 12 V positive earth system with a battery varying in capacity from 18 to 90 Ah, though 6 V systems are to be found on a number of Continental cars, including Renault, Volkswagen, Borgward, D.K.W., Porsche and Volvo, while manufacturers employing negative earth systems include Rolls-Royce, Bentley, Berkeley, Panhard and Volkswagen. One or two fuses protecting the main and auxiliary circuits are supplied in most systems, though variants are to be found. The Volkswagen has nine fuses, protecting individual circuits, the Triumph "Herald" and the Berkeley have no form of protection, and the Vauxhall has a cartridge fuse in the main circuit and a thermal interruptor with an open and reclose cycle of approximately 6 seconds in the horn and lights circuits to guard against damage and complete light failure due to a fault. This car also has two-speed windscreen wipers, as have the Armstrong-Siddeley, Austin "Princess," Daimler and Jaguar, and a current voltage control unit limiting the battery charge rate to 19 A maximum. On the Peugeot the fuses are mounted beneath the facia and can be changed from within the car.

Citroen have relinquished their l.t. distributor on the D.S.19 model in favour of the more orthodox h.t. system, while their new two-cylinder "Bijou" model has two coils, each with a contact breaking with each engine revolution, the plugs firing on the exhaust stroke also. An electro-magnetic pre-selective four-speed gear box is fitted to the 300 and 400 c.c. engined Goggomobil coupés, and a 12 V, 31 Ah battery weighing only 24 lb is used in the Lotus 7 sports car. The air conditioning system in the new Armstrong-Siddeley "Star Sapphire" limousine incorporates an air cooler operating on the vapour compression refrigeration principle. The compressor is driven from the engine through a magnetic clutch, and the surface temperature of the evaporator, past which two blowers discharge air into the car, is maintained constant by a thermostat linked to the clutch, which is disconnected if the temperature becomes too low. Rolls-Royce and Bentley have electrically controlled shock dampers on their rear axle suspension.

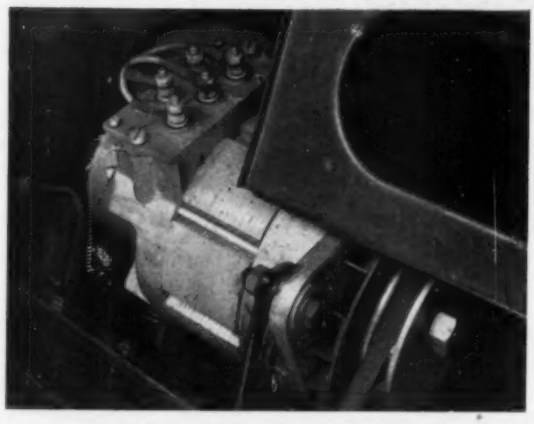
An indication of a future possible trend in automobile electrical systems can be seen on the Chrysler "Valiant," in which a 12 V d.c. system is fed by a three-phase alternator through six silicon diode rectifiers mounted in the die-cast aluminium housing giving full-wave rectification. The alternator has a maximum output of 35 A and delivers 10 A at the engine idling speed. It weighs 12 lb, less than 60 per cent of an equivalent d.c. generator, is self-regulating and requires no cut-out. Advantages claimed for this system, which in a similar form is now in general use on motor cycles, include a high output with small dimensions and weight; the absence of a commutator; and an output characteristic ensuring battery charging over a wide speed range, which at the lower end particularly benefits vehicles driven largely in towns necessitating frequent use of the starter and much engine idling. A 12 V, 36 A "Scintilla" synchronous star-connected alternator of a type fitted to police cars in a number of counties is shown on the Bosch, Ltd., stand, with lamps, horns, magnetos, power tools and sparking plugs, to which attention is drawn by a 3ft working model plug.

Electro-magnetic Transmission System

One contribution to easier driving is an electro-magnetic transmission system shown by Smiths Jacking Systems, Ltd., and incorporated in the "Easidrive" transmission fitted to the latest Hillman "Minx" and Singer "Gazelle," the first fully automatic three-speed stepped transmission system to be employed on small cars. The conventional friction type clutch is replaced by two magnetic powder couplings, in which metallic powder in an annular clearance between driving and driven members, rotating in a stator housing a coil, is arranged into columns across the clearance by the magnetic flux produced by the coil current. The torque transmitted is almost directly proportional to the coil current.

The combined starter motor and dynamo shown by Siba Electric, Ltd., for use with light car power units has a 12-pole stator carrying six starter and six generator windings, and an external bell type armature. When used with two-stroke engines, the field polarity can be changed by a solenoid switch and the engine run in either direction, a system employed in some ultra-light vehicles in place of a conventional reverse gear.

A starter for high-compression oil engines in which the pinion is engaged with the flywheel ring by a coaxial solenoid before full current is passed through the field and armature windings is shown by C.A.V., Ltd., who are also exhibiting their Mark III "Thermostart." This starting aid for diesel engines comprises a tubular valve



Bosch alternator installed in a car

body in a holder fitted within the inlet manifold. The valve is surrounded by a heater coil, an extension of which forms an igniter coil, and a stem on the body holds a ball valve closed. Current passing through the coil heats and expands the valve body, the valve opens and fuel enters and is vaporised. When the engine is cranked and air drawn into the manifold, the vapour is ignited, heating the manifold. The air flow in the manifold cools the valve body and closes the valve when the coil is switched off.

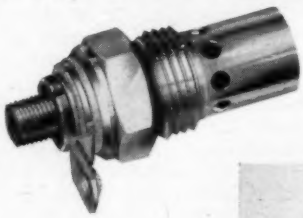
A number of new ranges of spark plugs are being shown. The "Hot Tip" plugs on the stand of the AC-Delco Division of General Motors, Ltd., have an aluminium oxide insulator and a copper-glass central electrode seal which maintains a hot deeply recessed electrode tip to burn combustion residues. One-piece plugs incorporating three flashover ribs in the insulator giving improved resistance to h.t. surface leakage are shown by K.L.G. Sparking Plugs, Ltd., while Marchal Distributors, Ltd., introduce a range of plugs having nickel silicium manganese alloy electrodes and high aluminium oxide content insulators. Lodge Plugs, Ltd., are showing their new "Road and Town" series which have an extended centre electrode insulator nose, giving increased resistance to fouling at low speeds and being sufficiently cool to prevent pre-ignition during consistent high speeds.

Vehicle Lamps

Among the new lamps displayed are the "Lumax" heavy duty driving and fog lamps shown by Ceag, Ltd., and a heavy duty 3½in diameter stop-tail lamp on the Wipac Group stand, all of which are wired for insulated return systems. Sealed headlamp units, in which a double transverse filament assembly with a bulb shield is sealed to the back of the unit and an internally aluminised glass reflector is fused to the front lens, are demonstrated by Joseph Lucas, Ltd. Advantages claimed for these units include maintained light quality and ease of beam aiming. Philips Electrical, Ltd., are showing a hand inspection lamp fitted with a 9in, 6 W fluorescent tube. The handle and hanging hook are protected by "Neoprene" rubber and the lamp unit is sealed in clear plastic.

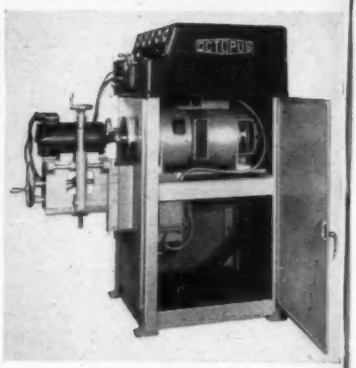
Among the additional instruments shown which can be fitted to give extra information on the engine and car services are the range of Lucas ammeters, available in standard forms or to match existing dashboard instruments. The engine speed indicator shown by S. Smith & Sons (England), Ltd., consists of an indicator head, containing a moving coil mechanism, a rectifying bridge and a voltage dropping resistor, and an engine driven transmitter having an a.c. output voltage proportional to engine speed. The fully transistorised electronic tachometer shown by Crypton Equipment, Ltd., indicates engine r.p.m. to an accuracy of 98 per cent using impulses in the ignition system. Ignition circuit impulses are transformed and rectified giving a d.c. output proportional to engine speed in the indicator developed in co-operation with the Record Electrical Co., Ltd., and shown by the Key-Leather Co., Ltd., who are also exhibiting an engine pre-heater having 200, 300 or 600 W elements inserted into the lower radiator hose and energised from the mains. Sub-panels to accommodate these extra instruments are shown by Smiths, suitable for two 2in units, while auxiliary switch panels shown to cater for the extra equipment fitted by many motorists despite the tendency of manufacturers to increase the number of accessories as standard items include those by Key-Leather, Lucas and D. H. Bonnella & Son, Ltd.

Few car batteries operate under ideal conditions or receive careful treatment and adequate maintenance, and must of necessity be of robust construction, although they are becoming progressively less bulky and heavy. Among the new batteries being shown are the Lucas low type seven-plate and standard nine-plate batteries having a streamlined cover with six rubber vent plugs which are a push-fit into the filler holes in the battery lid and incorporating a manifold venting system, and the low-priced "Peak Power" range shown by Park Bros., Ltd. Regular charging from a source other than the car generator prolongs battery life, and low-current chargers for home use are shown by Siemens Edison Swan, Ltd., Partridge Wilson & Co., Ltd., the Buckland Battery Co., Ltd., F. C. Heayberd & Co., Ltd., and Runbaken Electrical Products, who are also showing an oil-immersed trickle charger that can be permanently installed in a car, as can the Wipac mobile charger which has a fused change-over plug to select a 6 or 12 V output. Units for normal and rapid battery charging and for engine starting are exhibited by Partridge Wilson and Stenor, Ltd., whose universal model for 6, 12 or 24 V systems



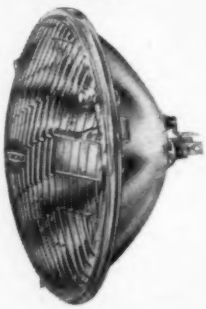
Left: C.A.V. "Thermostart" starting aid for diesel engines

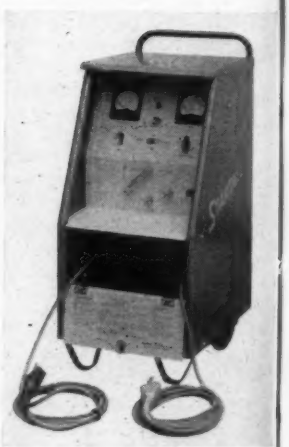
Below: Brunt "Octopus" variable speed motor electrical test bench



Above: Key-Leather engine pre-heater unit

Below: Lucas sealed-beam headlamp unit





Stenor universal engine starting and battery charging equipment

Laycock four-post electric lift

has a nominal output of 50 A continuously and 250 A intermittently.

Many exhibitors show equipment for the commercial garage intended to meet the requirements of the statutory safety inspection likely to be introduced shortly for cars over 10 years old. Brake testing equipment is included in the exhibits on the stands of Joseph Bradbury & Sons, Ltd., and Triangle Products, Ltd., who also show light-beam equipment for checking wheel alignment and steering geometry, while chassis distortion is among the defects which can be detected by the optical wheel alignment system shown by V. L. Churchill & Co., Ltd. Headlamp aligning can be carried out to within ½° by the Lucas "Beamsetter," which also measures the light intensity of the lamp. Equipment for general garage use includes wheel balancing machines by Repco, Ltd., and Laycock Engineering, Ltd., welding equipment by Triangle and the A.R.O. Machinery Co., Ltd., and the "Octopus" test bench for checking generators, starters, cut-outs, voltage regulators and ignition equipment on the Brunt Variable Speed Motors, Ltd., stand. This incorporates a 380/440 or 200/220 V single- or three-phase motor having a speed range infinitely variable between 0 and 6,000 r.p.m. A number of four-post electric lifts are shown. In the Laycock lift a 3 h.p. motor drives four screw-jacks through a continuous chain running under the vehicle platform, while in the Tecalemit lift the motor drives a single jack and in the Skyhi 3-ton lift the motor drives a hydraulic pump.

S.I.M.A. CONVENTION

Instrument Design and Production Techniques

THE eighth annual convention of the Scientific Instrument Manufacturers' Association (S.I.M.A.) was held at the Hotel Metropole, Brighton, from 22nd to 24th October. As with previous conventions held by the Association, the main purpose of the event was to provide an opportunity for instrument manufacturers and the users of instruments to meet and discuss their various problems.

Four convention panels were arranged which respectively dealt with instruments of the future, future materials and production techniques, organising for the future, and the individual and the company. Each panel was divided into four sessions at each of which one particular aspect of instrumentation was discussed. For instance, the panel dealing with instruments of the future, under the chairmanship of Mr. H. C. Pritchard (Cambridge Instrument Co., Ltd.), devoted its first session to travel, with Dr. W. Cawood (Deputy Controller of Aircraft Research and Development, Ministry of Supply) as the principal speaker. Dr. Cawood briefly surveyed the various forms of travel but said that he was prejudiced in favour of air travel; in fact, he thought that in the future all journeys of over about 50 miles would be by air. He spoke of likely future developments and said that there was a need for a completely automatic landing system which would provide an immense field for the instrument engineer. Furthermore, instrumentation of existing multi-engined aircraft should be simplified.

The second session of this panel was concerned with medicine and Mr. H. S. Wolff (Medical Research Council Laboratories) gave a most interesting address. He did not deal with well-established instruments which were in use in the medical field, but with those which were either under development or were very urgently wanted. From what he said it seemed that the medical profession was badly in need of more instrumentation. One of the reasons for this was lack of money. He felt a great deal of good would be done by the Medical Biological Engineering Society which was to start next June to provide a common meeting ground for doctors and engineers.

The speaker at the next session was Dr. C. P. Haigh (Director, Berkeley Nuclear Laboratories, C.E.G.B.) who discussed instrumentation in the nuclear age. He said that the instrument industry's part in the future would be to enable us to live with radiation. There was a real need for an instrument measuring neutron dosage and dealing with neutrons in the intermediate energy range. Much more attention needed to be devoted to detectors of ionising radiation. In the nuclear power field there was little "nuclear" instrumentation; in the main classical forms of measurement such as pressure, temperature, flow, length, and time were employed. In view of the position of some of the instruments in use today the main requirements were stability under radiation and reliability for long periods coupled with suitability for remote control and operation.

The speaker at the final session was Professor H. S. W. Massey (University College) who discussed the role of the instrument industry in the space age.

The first session of the panel dealing with future materials and production techniques under the chairmanship of Mr. T. W. Clifford (Taylor, Taylor & Hobson) was allied in that it dealt with environmental conditions applicable to ballistic missiles and satellite instrumentation, the speaker being Mr. K. A. McIntosh (Sperry Gyroscope Co., Ltd.).

The next speaker was Dr. H. M. Finniston (C. A. Parsons & Co., Ltd.) who considered trends in instrumentation, drawing attention to the growing importance of the electron as the "measuring device." He also considered the means by which electrons could move in different ways: this concept applied particularly to the growing field of semiconductors. New materials of future instrumentation would be made to exacting specifications demanding refined methods of manufacture and

control, and described some of the newer processes such as zone melting, vacuum casting and surface treatment.

The final session of this panel was concerned with electronic components for the future with Mr. J. H. Richards (Mullard, Ltd.) as the principal speaker. He said that it was already well recognised that in such applications the use of transistors offers great attractions. More recently it had become clear that revolutionary constructional techniques involving deposited components on flat substrates promised further advantages. Beyond this, one already visualised the displacement of individual components by small blocks of semiconductors so treated by alloying, diffusion, evaporation and other techniques as to constitute complete circuits.

LETTERS TO THE EDITOR

Letters should bear the writers' names and addresses, not necessarily for publication. Responsibility cannot be accepted for the opinions expressed by correspondents.

Domestic Appliance Exhibition

YOUR leading article of 23rd October under the above heading could convey a most misleading impression to your readers and in the interests of both truth and fair play I feel certain points should be emphasised.

In the first place the B.E.A.M.A. has always made it quite clear to its members that any individual manufacturer is at liberty to decide for himself those exhibitions in which he wishes to participate. Secondly, only a week before your article was published all member firms of the B.E.A.M.A. Domestic Appliances Division were notified of the B.E.A.M.A. Domestic Appliances *Board's* suggestions, and thoughts regarding participation in the Ideal Home Exhibition and any other exhibition which might cover domestic appliances. As this letter was sent out under confidential cover it would be quite improper for me to divulge its contents.

As far as I am aware there has been no subsequent meeting of the B.E.A.M.A. member firms involved, and it should be made quite clear that the B.E.A.M.A. Board (or Division) could not commit its individual members either way. I am sure many B.E.A.M.A. member firms will be disturbed by the impression which you give, that you have inside information that the majority of domestic appliance manufacturers will not support Mr. Thorogood's efforts to organise an Electrical Domestic Appliances Exhibition. If your article is based on information supplied by B.E.A.M.A. (I hope sincerely that this is not the case) it should be corrected immediately. Individual members will resist any attempt to force steam-roller decisions on them.

Mr. Thorogood should take courage from recent events. When a meeting of the 1958 B.E.P.C. exhibitors was held, the vast majority of those attending the meeting were in favour of supporting the 1959 President's known wishes on the subject of staging an exhibition at Torquay this year. Despite this, pressure groups started operating to try and "kill" the show. The exhibition went ahead, it was particularly successful, and the President paid a gracious compliment to the firms who participated. I have a grave suspicion that the same pressure is being exerted again. If it is via Press releases I think it is singularly disturbing.

In just recognition of the tremendous amount of work which Mr. Thorogood has put in on behalf of the industry exhibitionwise I feel it would be much more satisfactory if both the B.E.A.M.A. and the Press keep to the side-lines whilst individual firms make their own decisions. If an article is against a proposition it is essential that any statements made in it are strictly in accordance with the known facts.

Finally, it is perhaps profitable for us all to remember that the A.S.E.E. Electrical Engineers' Exhibition started its fantastically successful progress from a small church hall in South Harrow. One is prompted to ask whether it would have developed in such a spectacular way if it had received bad Press notices from its conception. With more fair play, and less interference from people who do not necessarily represent the views of the specialist firms interested vitally, we shall enjoy a better opportunity of making clearer decisions.

I must make it clear that I write this letter in my private capacity.

Harrow, Middx. ERIC S. CHISHOLM.

[The views expressed were entirely our own, based on experience of these matters. It was emphasised that the decision whether to participate in the exhibition or not was entirely in the hands of the manufacturers themselves, as they had to find the money.—Editors, *Electrical Review*.]

Buried Transformers

THE buried transformer principle for substations seems to be an ideal conception to suit difficult sites, but as presented it appears to suffer from a lack of flexibility.

The single circuit l.v. output will in most cases have to be taken to some form of fusing unit to provide protection to individual feeders and one wonders if this could be incorporated in the cooling radiator paying due regard, of course, to the proximity of oil as a fire hazard and to the higher ambient temperature that the fuses would be subjected to.

A further refinement to the unit would be a flexible drive to the tap-changing switch, terminating in the cooling radiator, rendering the provision of an inspection cover to carry out voltage adjustments unnecessary.

Kuching, Sarawak. R. BECKERLEG.

Electricity in the Home

MAY I congratulate you on the supplement in your 16th October issue, "Electricity in the Home."

I feel, however, that it would have a greater value by publication in one of the women's journals. The readers of the *Review* are more or less converted to the necessity of having all the available domestic electrical appliances in their homes. If they're not, they should be!

London, S.W.1. J. W. SIMPSON,
Secretary,
British Electrical Power Convention.

R.S.A. Lectures

CANTOR Lectures on "Modern Technological and Commercial Education" will be delivered by Mr. A. A. Part, Dr. P. F. R. Venables and Dr. A. J. McIntosh at the Royal Society of Arts, John Adam Street, Adelphi, London, W.C.2, on 9th, 16th and 23rd November.

OVERSEAS ELECTRICAL TRADE

NINE MONTHS' FIGURES ANALYSED

A FALL in exports is normally expected in September, since it is only then that the full effect of the August holidays is felt, and the lower figure for electrical exports last month is in keeping with the pattern of earlier years. The month's total of £17 million compares with £17·5 million in August and £19·9 million in July. The total for the year to the end of September was 4 per cent higher than in the corresponding period of last year, but still some £2 million below the record level of 1957.

However, the expansion did not start until the second quarter of the year, and taking the second and third quarters together exports have been 10 per cent higher than during the corresponding period of 1958. Since the present progress may be expected to continue there is a good chance that the total of £227·2 million achieved in 1957 will be surpassed.

In contrast to the decline in total British exports to the Sterling Area, which were 6½ per cent less in January

TABLE I.—ELECTRICAL EXPORTS

Class	Month of Sept., 1959	Nine months ended 30th September, 1958	Nine months ended 30th September, 1959
	£	£	£
Generating sets and generators:			
Diesel-driven, up to 10 kW	123,051	1,057,420	978,506
Ditto, 10 to 65 kW	119,363	1,794,942	1,208,930
Ditto, 65 to 200 kW	121,352	1,757,770	1,442,004
Ditto, over 200 kW	203,645	3,698,861	2,549,961
Spark ignition engine driven	5,482	150,191	103,637
Steam turbine driven	4,949	682,004	619,185
Hydraulic turbine driven	—	17,542	—
Other prime mover driven	20,296	156,422	238,600
Generators, not exceeding 200 kW	95,350	1,185,517	889,657
Ditto, over 200 kW	19,947	870,036	765,581
Parts of generators	575,035	5,108,205	5,875,750
Motors, complete, other than railway, tramway and trolley-bus:			
Up to ½ h.p.	151,112	1,359,025	1,449,373
Over ½ but under 1 h.p.	35,343	437,928	406,897
1 h.p. to 250 h.p.	370,998	4,030,138	3,709,992
Over 250 h.p.	410,462	1,025,539	1,820,210
Railway, tramway and trolley-bus motors complete and parts of all motors	210,548	1,902,832	2,301,554
Motor starting and controlling gear	245,738	2,263,158	2,964,700
	2,712,671	28,297,530	27,324,537
Converting machinery	18,338	257,406	429,145
Mercury-arc rectifiers	42,701	957,354	616,773
Transformers for lighting, heating and power (incl. coils):			
Not exceeding 7,500 kVA	407,124	5,481,452	4,151,181
Over 7,500 kVA	254,182	3,767,047	3,704,165
Switchgear and switchboards (not telegraph or telephone), up to 200 A and 660 V	293,999	3,587,151	3,201,807
Ditto, other	750,073	8,965,368	10,634,804
	1,766,417	23,015,778	22,737,875
Primary batteries:			
Lighting	108,471	795,113	879,770
Radio	297,790	2,644,785	3,040,884
Other	41,861	410,191	323,408
Parts (excl. carbons)	46,167	420,842	421,844
Lamps:			
Filament, exceeding 28 V	87,339	729,814	784,561
Ditto, under 28 V	22,495	261,497	244,797
Arc lamps and searchlights	17,157	161,467	150,145
Discharge lamps, fluorescent tubes, etc.	81,015	759,052	803,061
Radio and television, etc., apparatus:			
Thyratrons, hot cathode mercury vapour and gas-filled rectifiers (excl. mercury-arc rectifiers), photo-electric cells, stabilising and cold cathode valves, magnetrons, klystrons	46,774	235,476	384,218
All other*	364,369	3,639,347	4,416,198
Parts (excluding glass bulbs)	30,708	184,438	268,676
Radio and television transmitters	91,425	231,018	841,761
Commercial radio and radar equipment	1,518,641	10,465,234	13,831,304
Domestic radio receivers, mains	88,325	737,287	772,443
Ditto, battery	55,253	451,099	505,676
Ditto, other (incl. car)	14,239	188,358	268,903
Radiograms	26,781	281,960	212,845
Television sets	47,453	733,806	555,501
Public address equipment	79,950	811,820	817,640
Other radio and television apparatus, n.e.s.	83,750	265,141	618,447
Components and parts, n.e.s.	671,854	6,685,201	7,145,318
	3,119,522	24,910,185	30,638,930
Telegraph and telephone installations	368,758	6,581,205	6,451,392
Telephone instruments, separately consigned	132,110	1,485,394	916,629
Telegraph and telephone parts	684,022	6,886,585	6,933,789
Line apparatus for long distance communication	521,488	1,573,122	2,242,086
	1,706,378	16,526,306	16,543,896

Class	Month of Sept., 1959	Nine months ended 30th September, 1958	Nine months ended 30th September, 1959
	£	£	£
Cookers	32,381	496,078	333,539
Toasters	19,359	209,223	153,084
Other cooking apparatus	33,389	290,276	331,642
Parts and accessories	84,695	534,677	772,200
Space heating appliances	21,944	266,595	209,154
Water heating appliances	20,596	225,283	253,100
Other heating appliances	21,650	265,813	219,390
Parts and accessories	70,181	593,572	699,981
Irons	71,091	665,707	620,356
Arc welding equipment, a.c.	28,014	433,024	326,177
Ditto, d.c.	50,286	704,721	446,925
Resistance welding equipment	49,490	126,304	311,735
Electric furnace plant	56,848	878,509	759,243
Magnetos, ignition	8,305	130,440	114,831
Sparking plugs	131,566	1,346,852	1,439,734
Elec. appliances for aeroplanes, n.e.s.	344,034	2,473,847	2,965,370
Ditto, for motor vehicles, n.e.s.	385,234	3,373,372	3,497,433
Ditto, for cycles, n.e.s.	36,296	461,067	350,350
Signalling app. (incl. traffic signals)	135,557	1,215,046	1,939,879
Instruments, commercial	143,877	1,565,271	1,535,489
House service meters (including parts)	174,937	1,292,742	1,219,719
Electro-medical apparatus (not X-ray)	31,300	488,555	277,654
X-ray apparatus (excl. tubes and valves)	45,713	490,335	452,098
Ceiling fans, complete	48,977	941,027	759,429
Desk fans, complete and parts of desk and ceiling fans	34,981	287,052	193,897
Vacuum cleaners	157,850	1,107,135	1,231,693
Floor polishers	42,682	605,455	639,492
Food mixers	58,317	498,262	590,107
Hair clippers and dry shavers	72,476	467,098	441,067
Other portable appliances	17,699	153,387	194,068
Parts	124,316	951,726	1,117,644
Portable elec. tools (not saws) and parts	174,583	1,860,172	1,819,651
Cables and wires:			
Telegraph and telephone, submarine	527,541	623,503	4,011,291
Ditto, other	244,494	4,642,252	3,411,087
Cotton, silk or art. silk insulated	25,586	383,664	168,877
Enamel, glass or asbestos insulated	80,967	869,251	783,728
Paper insulated	356,523	5,870,716	4,939,677
Rubber insulated	245,890	3,985,940	2,538,005
Thermoplastic insulated	422,889	1,708,074	2,323,666
Other	135,082	1,939,203	1,408,635
	2,038,972	20,022,603	19,584,966
Accumulators for motor vehicles	117,371	1,384,566	1,282,976
Ditto, traction	15,588	173,970	181,598
Ditto, radio and other portable	38,019	533,039	270,938
Ditto, other	21,111	290,999	456,445
Parts and accessories	95,190	844,213	734,164
Electric wiring accessories	166,721	1,532,307	1,813,792
Elec. ceramic ware, etc. (incl. insulators), n.e.s.	71,643	936,407	902,046
Insulating cloth and tape	72,691	439,829	481,989
Other insulating material	118,109	881,113	1,228,940
Permanent magnets	41,812	437,973	405,571
Radio, telegraph and telephone testing equip., n.e.s.	123,041	606,843	1,112,296
Scientific elec. instruments (excl. telegraphic or telephonic, time recorders and time switches)	331,263	3,232,546	3,183,988
Electrical machinery, n.e.s.	35,258	738,759	254,763
Electrical apparatus and appliances, n.e.s.	999,265	7,550,398	8,929,827
TOTAL	17,021,961	163,936,748	170,934,138

TABLE 2.—DISTRIBUTION OF EXPORTS (TABLE 1)

Country	Month of Sept., 1959	Nine months ended 30th September, 1958	Nine months ended 30th September, 1959
	£	£	£
Gibraltar	5,627	251,048	89,525
Malta and Gozo	36,734	554,858	352,299
Cyprus	39,832	676,462	505,652
Sierra Leone	27,174	514,304	312,609
Ghana	172,485	1,338,559	2,047,916
Nigeria	357,503	3,244,014	4,149,047
Union of South Africa	1,082,231	14,423,146	14,210,313
Rhodesia and Nyasaland	355,190	3,865,914	5,716,214
Tanganyika	43,477	417,719	376,535
Kenya	235,304	1,169,948	1,560,595
Uganda	23,476	490,419	397,393
Mauritius	40,669	334,787	421,550
Aden	43,306	474,941	448,469
Bahrain, Qatar and Trucial States	140,040	844,594	920,457
Kuwait	179,495	1,488,957	1,729,504
India	1,728,813	13,610,984	15,218,271
Pakistan	145,146	1,994,829	2,125,744
Singapore	187,558	2,870,576	2,219,730
Federation of Malaya	139,085	2,533,997	2,018,401
Ceylon	118,999	1,407,118	1,705,189
British North Borneo	18,664	169,051	285,939
Sarawak	12,122	207,396	124,777
Hong Kong	302,121	2,573,253	3,608,960
Australia	1,455,755	14,004,255	13,301,965
New Zealand	651,764	10,016,973	6,711,878
Fiji	18,731	238,420	253,511
Canada	1,800,919	10,466,201	9,703,097
Jamaica	114,683	1,236,082	1,286,417
Barbados	17,999	230,575	280,978
Trinidad	138,388	999,583	1,103,940
British Guiana	40,078	588,494	582,777
Other Commonwealth countries	258,810	1,371,742	1,902,660
Irish Republic	294,894	2,529,424	2,672,610
Soviet Union	99,221	448,701	985,804
Finland	118,971	1,039,124	905,374
Sweden	302 570	3,961,013	4,077,050
Norway	158,359	1,850,651	1,850,629
Denmark	208,099	1,689,690	2,010,462
Poland	66,314	632,892	571,005
Western Germany	357,799	2,537,332	4,602,911
Netherlands	612,139	5,462,713	5,632,868
Belgium	241,503	2,341,697	2,644,657
France	245,054	1,977,773	2,266,278
Switzerland	172,156	1,504,914	1,510,365
Portugal	129,418	2,599,601	1,816,605
Spain	359,636	1,353,861	1,569,710
Italy	276,786	2,488,682	2,727,462
Austria	34,836	405,179	400,030
Yugoslavia	63,045	580,798	618,263
Greece	109,882	729,572	1,031,118
Turkey	57,713	958,786	531,203
Belgian Congo	44,413	330,344	451,701
Portuguese East Africa	26,394	199,344	218,981
Egypt	74,030	875,769	1,412,441
Libya	30,218	518,089	629,327
Morocco (excluding Tangier)	20,508	344,235	276,761
Sudan	61,988	852,430	761,567
Syria	13,194	249,674	213,338
Lebanon	43,259	409,176	457,139
Israel	58,357	881,345	948,177
Jordan	35,218	576,856	684,298
Saudi Arabia	52,494	687,775	495,065
Iraq	245,771	2,515,719	2,489,704
Iran	158,090	3,059,270	2,518,885
Burma	113,743	629,411	879,874
Thailand	50,692	1,057,009	771,167
Indonesia	17,821	258,076	337,121
Japan	79,874	409,426	629,325
United States of America	896,760	5,813,117	11,270,002
Cuba	22,669	642,237	294,515
Mexico	48,931	433,994	421,940
Colombia	24,614	295,984	274,059
Venezuela	238,009	3,605,262	3,170,602
Peru	26,919	382,347	303,351
Chile	39,534	452,618	855,734
Brazil	114,549	836,961	721,632
Uruguay	4,358	40,369	68,675
Argentine Republic	165,699	3,310,950	1,783,296
Other foreign countries	273,282	3,567,359	3,498,745
TOTAL	17,021,961	163,936,748	170,934,138

TABLE 3.—SOURCES OF ELECTRICAL IMPORTS

Country	Month of Sept., 1959	Nine months ended 30th September, 1958	Nine months ended 30th September, 1959
	£	£	£
Australia	39,868	473,478	349,474
Canada	124,505	763,313	810,599
Other Commonwealth countries	222,996	1,009,821	1,306,218
Irish Republic	124,494	643,688	791,303
Sweden	80,948	828,830	898,179
Denmark	51,538	405,907	463,966
Western Germany	670,928	4,063,995	5,509,537
Netherlands	605,209	3,058,456	4,502,628
Belgium	38,418	402,657	393,374
France	97,138	945,099	1,252,673
Switzerland	163,503	961,139	1,293,252
Italy	90,902	570,394	783,722
United States of America	1,204,190	5,813,044	8,153,696
Other foreign countries	178,788	1,133,093	2,055,311
TOTAL	3,693,425	21,072,914	28,563,932

to September than a year earlier, electrical exports showed a slight increase. The fall compared with 1958 of £4·2 million in shipments to the three Southern Dominions, South Africa, Australia and New Zealand, was more than offset by the greater shipments to India (up by £1·5 million) and many of the smaller markets.

The most spectacular increase has been in exports to the United States, which rose by £5·5 million or 94 per cent. Canada, on the other hand, took £800,000 less, and with the exception of Chile and Uruguay there have been smaller shipments this year to Latin America. An increase in exports to all the Common Market countries except France resulted in a total rise of nearly £2 million to £17·7 million. There was an overall fall in exports to the "Outer Six" (Austria, Denmark, Norway, Portugal, Sweden and Switzerland) of £400,000.

The increase in the January to September total of £7 million was mainly due to the continued rise in exports of radio equipment, which were 23 per cent above the 1958 level. Among the important advances in other items was an increase of 72 per cent to £7 million of exports of electric and diesel-electric locomotives.

Imports of electrical goods increased by nearly half-a-million in September to £3·7 million, bringing the nine months' total to £28·6 million, 36 per cent more than in 1958. Re-exports of electrical goods for January to September amounted to £337,000, 4 per cent more than in 1958.

TABLE 4.—OTHER ELECTRICAL AND ALLIED EXPORTS

Class	Month of Sept., 1959	Nine months ended 30th September, 1958	Nine months ended 30th September, 1959
	£	£	£
Washing machines, electrically operated:			
Not exceeding 150 lb weight	325,217	3,056,217	2,551,639
150 lb to 250 lb	52,059	700,427	438,186
Parts	63,359	677,749	707,738
Electric locomotives (incl. battery types)	174,320	2,510,355	4,261,395
Diesel locomotives with electrical transmission	161,808	1,510,423	2,633,708
Welding electrodes:			
Ferrous	95,175	795,953	780,842
Non-ferrous	18,998	248,112	195,943
Electric conduit tubes and cased tubes	56,922	514,962	534,742
Electric carbons	98,149	461,794	902,183
Electric lighting fittings and lanterns (excl. arc lamps, searchlights and cycle lamps)	256,510	2,785,607	2,605,812
Electric fork-lift trucks	67,263	613,767	652,613
Steam turbines (excl. marine)	640,304	5,721,167	8,040,106
Water turbines	163,203	1,783,860	3,044,595

TABLE 5.—ELECTRICAL IMPORTS

Class	Month of Sept., 1959	Nine months ended 30th September, 1958	Nine months ended 30th September, 1959
	£	£	£
Generators, incl. parts	102,513	688,874	654,704
Motors, incl. parts	164,726	798,007	1,126,758
Convertors; transformers; rectifiers*	85,313	271,574	815,098
Switchgear and switchboards (not telegraph and telephone)	95,814	477,287	829,651
Cathode ray tubes, complete	286,520	419,488	1,299,547
Other valves, complete*	326,382	1,580,736	2,151,221
Parts (excl. glass bulbs)*	80,104	336,581	613,950
Radio receiving sets, domestic or portable	50,067	115,764	252,972
Radio communication and navigational aids, complete	436,493	2,709,036	3,502,704
Other radio and TV apparatus, parts and accessories	284,362	2,910,055	2,987,934
Apparatus for telegraphy and telephony	40,275	944,333	815,223
Welding machinery	61,176	242,293	480,195
Cooking and heating apparatus	145,361	1,091,871	1,223,747
Magnetos, ignition, and electric appliances for aeroplanes, motor vehicles and cycles	238,536	1,908,871	1,623,968
Electro-medical apparatus (incl. X-ray apparatus)	93,702	533,588	769,270
Portable mechanical appliances, electrically operated, complete	128,947	785,145	990,100
Parts	60,114	568,871	489,834
Scientific electrical instruments (excl. telegraphic and telephonic)	168,213	1,329,152	1,268,733
Other machinery, apparatus and appliances	844,807	3,362,212	6,668,323
TOTAL	3,693,425	21,072,914	28,563,932

* The figures for 1959 are not completely comparable with those for 1958.

I.E.E. SUB-CENTRE CHAIRMEN

Biographies of Officers for the 1959-60 Session

MANY of the Sub-Centres of the Institution of Electrical Engineers have a membership comparable with the Centres, and the chairmen are well-known men in their respective spheres. We have referred to the chairmen of the Centres in a previous issue, and we now give below details of the careers of the Sub-Centre chairmen.

Mr. D. H. McCracken, B.Sc.Tech., M.I.E.E., A.M.I.Mech.E. (East Anglian) was educated at Hymers College, Hull, and at the Manchester College of Technology. He received his post-graduate training at the Witton Works of the General Electric Co., Ltd., after which he had industrial experience in the designing and estimating departments of the Electrical Apparatus Co., Ltd., St. Albans, and subsequently as electrical development engineer to Petters, Ltd., Yeovil. He was appointed lecturer in electrical engineering at Norwich Technical College in 1936, and is now head of the Engineering Department at the Norwich City College and Art School.

Mr. O. Seymour, A.M.I.E.E. (North Lancashire) is head of the Electrical Engineering Department of Blackburn Municipal Technical College. He received his training at Whitwood Mining and Technical College, and commenced his career in mining electrical engineering. After a period as part-time lecturer at Whitwood College, he was appointed to the full-time staff of the Electrical Engineering Department of Leicester College of Technology in 1947, going to Blackburn in 1952.

Mr. A. Asbury, B.Sc., M.I.E.E. (North Staffordshire) gained a first class honours degree in the School of Electrical Engineering, Birmingham University, and was awarded the Heslop Memorial Medallion. He joined the English Electric Co., Ltd., Stafford, in 1938 and in 1943 became liaison engineer at the Westinghouse Electric Co., Pittsburgh, U.S.A. He returned to the special engineering section of the English Electric Co. at Stafford in 1946 and is now chief engineer, data processing and control systems division, Kidsgrove Works. In May this year he was one of a team of automatic control engineers who visited Russia under the leadership of Professor A. Tustin.

Mr. W. J. Gibbs, D.Sc., M.I.E.E. (Rugby) is manager of the Engineering Mathematics Department of the British Thomson-Houston Co., Ltd. He was educated at Colston's School and Bristol University, and joined the B.T.H. Co. in 1923 as design engineer. He was co-organiser of the Tensor Club of Great Britain with S. Austen Stigant, and is the author of "Tensors in Electrical Machine Theory," "Conformal Transformations in Electrical Engineering," and part author of "Polyphase Commutator Machines."

Mr. A. J. O. Cruickshank, B.Sc.(Eng.), Ph.D., A.M.I.E.E. (North Scotland) was lecturer in electrical engineering at the University of St. Andrews, Queen's College, Dundee, from 1955 until the beginning of this month when he was promoted to Reader in Electrical Engineering. He graduated in 1944 with first class honours in electrical engineering from the University of St. Andrews and joined the research staff of the General Electric Co., Ltd., Witton. From 1946 to 1953 he was lecturer in electrical engineering at the University of Glasgow, and obtained his Ph.D. degree at that University. He returned to Queen's College in 1953 as the senior Edward A. Deeds Research Fellow to carry out work on non-linear circuits and control systems. Dr. Cruickshank is the author of a number of research papers and in 1958 was awarded the Heaviside Premium of the I.E.E. for two papers published in its *Proceedings*.

Dr. A. J. O. Cruickshank

Mr. J. E. Sayers

Mr. D. M. Thornton

Mr. J. E. Sayers, B.Sc., M.I.E.E. (South-West Scotland) is chief engineer of James Howden & Co., Ltd., Glasgow. After graduating at Glasgow University and two years' post-graduate training with the Metropolitan-Vickers Electrical Co., Ltd., he was for some years with James E. Sayers & Crum, consulting engineers, Glasgow. In 1940 he joined the Works Directorate of the Air Ministry and for the next seven years was closely associated with the design and installation of all forms of mechanical and electrical equipment for airfields and other Air Ministry establishments, latterly serving as mechanical and electrical engineer at R.A.F. Headquarters, Iraq Command (Habbaniya). He joined James Howden & Co., Ltd., Glasgow, in 1947 as electrical engineer to take charge of the electrical engineering activities of the company which later embraced large-scale development and contract work on electroprecipitators. He became manager of the Dust Handling and Electrical Division in 1957 and in August last year was appointed chief engineer of the company.

Mr. D. M. Thornton, B.Sc., M.I.E.E. (South-East Scotland) was educated at George Heriot's School, Edinburgh, and Edinburgh University, graduating in 1923, following which he served in various capacities with the Lothians Electric Power Co., the Electricity Departments of Dumfries and Kirkcudbright County Councils, and the South East Scotland Electricity Board until taking up his present position of engineer for the Borders District, Edinburgh and Borders Area, of the South of Scotland Electricity Board. Most of his career has been in rural development.

Mr. F. G. Tyack, A.M.I.E.E. (Sheffield) is sales manager, industrial permanent magnets, with James Neill & Co. (Sheffield), Ltd. He received his electrical training with Siemens Bros. & Co., Ltd., Woolwich Polytechnic and the Borough Polytechnic, and became telephone engineer with Siemens; he spent several years on automatic exchange installation work, specialising in the development of automatic testers (forerunners of autoroutiners). For seven years he was

Mr. D. H. McCracken

Mr. O. Seymour

Mr. A. Asbury

Mr. F. G. Tyack

Mr. A. G. R. Bell

Mr. M. A. Raisbeck

Mr. J. Harley

engineer-in-charge of vehicle-actuated traffic signal controllers, for which he holds several patents. He was awarded the Students' and Fahie Premiums by the I.E.E. for papers on traffic signals. He served in the Army in the last war, attaining the rank of major, and later was seconded to the Control Commission for Germany. He joined James Neill & Co. (Sheffield), Ltd., on returning to civilian life.

Mr. A. G. R. Bell, A.M.I.E.E., A.M.I.Mech.E. (South Western) is generation engineer (south), South Western Division of the C.E.G.B., and is responsible for the operation of all generating stations in the South Group of the Division. He served his apprenticeship as a student in the power station of the Sheerness & District Electricity Co., after which he was a junior engineer at Burnley power station. In 1933 he joined the North Eastern Electric Supply Co., Newcastle-on-Tyne, and the following year became system control engineer with the L. & N.E. Railway in the Tynside electrified area. In 1938 he joined the South Lancs. Transport & Power Co. to become shift charge engineer at Atherton power station, later serving at Kearsley power station, first as assistant charge engineer and then as technical assistant and efficiency engineer. In 1945 he was appointed deputy station superintendent at Longford power station, Coventry, and three years later became station superintendent at Wallasey where he served for two years before becoming superintendent of the new Bromborough power station, which was one of the first stations operating on advanced steam pressure and temperature conditions. He took up his present position in 1955.

Mr. M. A. Raisbeck, A.M.I.E.E. (Tees-Side) received his technical education at the Constantine Technical College, Middlesbrough, and served an apprenticeship with Dorman, Long & Co., Ltd. After various works appointments he became assistant chief electrical engineer of the company in 1949 and was responsible for the electrical equipment required for the company's post-war development schemes, particularly that of the new universal beam mill at Lackenby. He was appointed works manager (engineering and services) at Lackenby in 1957.

Mr. J. Harley, M.I.E.E., A.M.B.I.M. (West Wales (Swansea)) is manager of the Bridgend District of the South Wales Electricity Board. He received his technical education at Leeds Central and Wolverhampton Technical Colleges and, after a student apprenticeship, entered the supply industry in 1926 with the Yorkshire Electric Power Co. He was later with the West Midlands Joint Electricity Authority and was appointed engineer of the Shrewsbury District of the Midlands Electricity Board in 1948. In 1950 he became commercial manager, Llanelly District, of the South Wales Electricity Board, and was appointed to his present post in December last year.

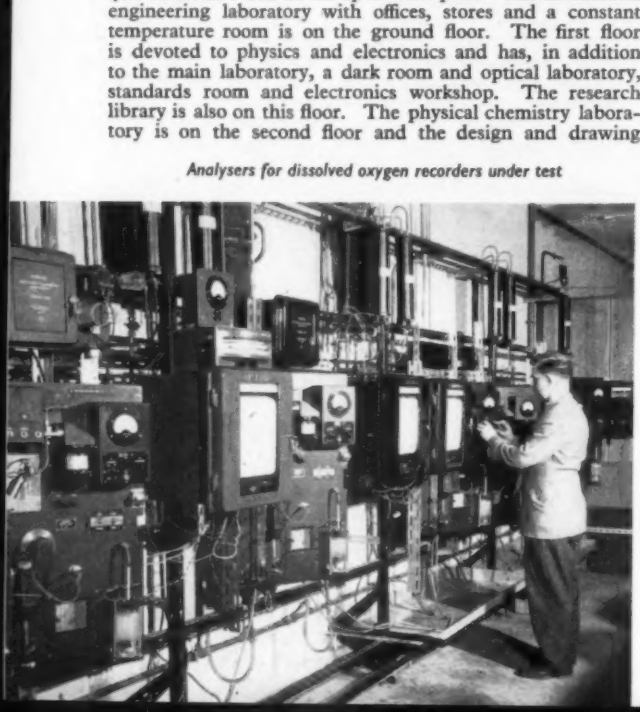
RESEARCH LABORATORIES AT CAMBRIDGE

RECENTLY we visited the new research laboratory block at Cambridge of the Cambridge Instrument Co., Ltd., following the opening ceremony on 14th October by Lord Adrian. The new building, which has a floor area of some 20,000 sq ft, has a three-storey entrance block housing a reception area, telephone exchange, lift and staircase, and the offices of the head of the research department on the top floor. The main block consists of four 100 by 40ft floors laid out on an open-vista plan. The mechanical engineering laboratory with offices, stores and a constant temperature room is on the ground floor. The first floor is devoted to physics and electronics and has, in addition to the main laboratory, a dark room and optical laboratory, standards room and electronics workshop. The research library is also on this floor. The physical chemistry laboratory is on the second floor and the design and drawing office on the top floor. All windows are double glazed to reduce heat and sound transference.

The new entrance and laboratory block

A link block behind the main laboratory provides access to the factory buildings, and during our visit we saw the manufacture and testing of instruments for medical, scientific and engineering applications. These included gas analysers for use with hydrogen cooled alternators, and electro-chemical dissolved oxygen recorders of the gas transfer type for measuring the oxygen content of boiler feed water. These are designed specifically for oxygen determination, are unaffected by impurities or additives and have an accuracy better than 0·0005 parts per million by weight.

Analysers for dissolved oxygen recorders under test



GENERATION and DEVELOPMENT

Higher Consumption in Industrial Areas

Last year and in the early part of this year domestic consumers set the pace in the expansion of electricity consumption. With the quickening of industrial production, however, the position has now changed and the latest figures issued by the Electricity Council—for September—show that increases in sales were greatest in the mainly industrial areas, the North Eastern and Yorkshire Boards leading with 12·7 and 12·2 per cent respectively. The national figures for England and Wales show an increase of 7·9 per cent over September, 1958, but the Council states that, when corrected for weather and working days, this is equivalent to 9·9 per cent.

Electricity generated by the Central Electricity Generating Board, the South of Scotland Electricity Board and the North of Scotland Hydro-Electric Board in September totalled 7,752 million kWh, 6·9 per cent more than in September, 1958. To this total must be added the supplies available from the United Kingdom Atomic Energy Authority's stations which, during the five weeks ended 3rd October last, amounted to 127·5 million kWh compared with only 15 million kWh in the corresponding period of 1958.

There was a net increase in plant installed in September of 301 MW. At C.E.G.B. stations 60 MW sets (English Electric, Metropolitan-Vickers and Richardsons Westgarth) and 550 klb/hr boilers (John Brown (2) and Mitchell) were commissioned at Belvedere, Elland and South Denes. A 120 MW Parsons set and 850 klb/hr John Brown boiler were installed at the South of Scotland Board's Kincardine station and a 550 kW Boving & Co. compensation set at the Loyne station of the North of Scotland Hydro-Electric Board.

East Midlands Rural Electrification

When the East Midlands Electricity Board assumed responsibility for electricity distribution in its 6,300 sq mile area in 1948, a supply had been given to 11,805 of the 27,400 potential farm consumers. The official switching-on of a supply to Grove Hill Farm, near Buckingham, on 23rd October, performed by Earl Waldegrave, Parliamentary Secretary to the Ministry of Agriculture, Fisheries and Food, brought the number of farms connected up to 25,000, over 91 per cent of the total in the area. In addition to the usual domestic services, the electrical equipment at present installed at Grove Hill, a 280-acre mixed farm, includes a 1 ton platform grain dryer with a 12 kW heater and a fan driven by a ¾ h.p. motor; an automatic hammer mill with food mixer, driven by two 3 h.p. motors; infra-red heating in the piggeries; and a domestic water supply pump. An electric hoist is to be installed shortly. The 415 V three-phase supply is at present provided from the 11 kV system through a 100 kVA transformer originally installed to feed a wartime Army camp, though this is to be replaced by a 25 kVA unit.

At a luncheon following the ceremony, the toast of "The Electricity Supply Industry" was proposed by Earl Waldegrave, who referred to the vigorous way in which the difficulties of supplying farms in remote

ELECTRICITY GENERATED AND SENT OUT FOR PUBLIC SUPPLY

	Fuel consumed Thousand tons			kWh generated Millions			kWh sent out Millions	Installed capacity (m.c.r.) MW
	Coal	Coke and Breeze	Oil	Steam	Water power	Total		
Central Electricity G.B.	3,035	84	335·8	7,169	1	7,174	6,729	26,522
North of Scotland H.E.B. ...	14	—	1·1	28	107	139	138	1,031
South of Scotland E.B.	222	3	0·3	435	4	439	412	1,771
Total for September, 1959 ...	3,271	87	337·2	7,632	112	*7,752	7,279	29,324
Corres. total for September, 1958	3,218	81	260·7	7,091	150	7,250	6,816	27,238
Inc. or dec., per cent	+1·6	+8·0	+29·3	+7·6	−25·3	+6·9	+6·8	+7·7
Total to date (9 months), 1959...	32,354	850	2,957·4	73,238	1,387	74,718	70,269	
Total for corres. 9 months of 1958	33,000	719	1,569·2	68,962	1,491	70,566	66,364	
Inc. or dec., per cent	−2·0	+18·1	+88·5	+6·2	−7·0	+5·9	+5·9	

* The total figure includes generation by other methods amounting to 8 million kWh.

ELECTRICITY SENT OUT BY AREA BOARDS FOR THEIR CONSUMERS

Board	Totals for September (million kWh)			Twelve Months Totals Ended 30th September (million kWh)		
	1958	1959	Inc. or Dec. %	1958	1959	Inc. or Dec. %
London	499·5	507·7	+ 1·6	7,563·5	7,894·3	+ 4·4
South Eastern	358·9	378·0	+ 5·3	5,071·4	5,414·4	+ 6·8
Southern	473·6	501·2	+ 5·8	6,399·3	7,046·8	+10·1
South Western	232·5	241·7	+ 4·0	3,108·8	3,324·3	+ 6·9
Eastern	584·2	616·3	+ 5·5	8,069·8	8,596·0	+ 6·5
East Midlands*	517·7	558·8	+ 7·9	6,724·9	7,188·2	+ 6·9
Midlands*	665·8	724·8	+ 8·9	8,715·9	9,391·9	+ 7·8
South Wales*	415·0	444·3	+ 7·1	5,006·1	5,278·2	+ 5·4
Merseyside and N. Wales* ...	407·3	439·9	+ 8·0	5,272·6	5,580·8	+ 5·8
Yorkshire*	644·9	723·6	+12·2	8,605·6	9,014·6	+ 4·8
North Eastern*	384·5	433·5	+12·7	5,045·1	5,302·4	+ 5·1
North Western*	667·2	714·6	+ 7·1	8,919·5	9,234·9	+ 3·5
Total all Area Boards	5,851·1	6,284·4	+ 7·4	78,502·5	83,266·8	+ 6·1
Direct Supplies by C.E.G.B. ...	239·7	286·7	+19·6	2,867·4	3,284·2	+14·5
Grand Total	6,090·8	6,571·1	+ 7·9	81,369·9	86,551·0	+ 6·4
Mainly Industrial Areas*	3,702·4	4,039·5	+ 9·1	48,289·7	50,991·0	+ 5·6
Mainly Non-Industrial Areas ...	2,148·7	2,244·9	+ 4·5	30,212·8	32,275·8	+ 6·8
South of Scotland E.B.	470·5	516·0	+ 9·7	6,493·4	6,989·0	+ 7·6
North of Scotland H.E.B. ...	105·4	113·6	+ 7·8	1,508·9	1,584·6	+ 5·0

* Those in which industrial consumers took over 50% of the total sales in the preceding financial year.

Mr. C. R. King speaking at the connection of the 25,000th farm in the area of the East Midlands Electricity Board

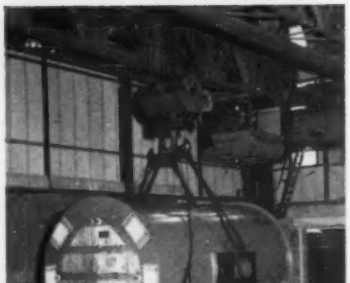
areas were being tackled. It was now generally accepted that electricity was as important to the farmer as to the townsmen and industrialists, for modern farming could not be carried on without its use, and the former criticism that the farmer made inadequate use of the supply provided was no longer valid. In paying tribute to the Board's work in rural electrification, he thought that the tunnel crop drying development was particularly creditable.

In his reply, Mr. C. R. King, chairman of the Electricity Council and former chairman of the Board, said that the biggest problems with rural schemes arose with wayleaves. Although no one wished to spoil the countryside, more overhead lines must be erected if electrical development was to continue. One of the important aspects of rural electrification was its help in keeping people on the land by providing the amenities usually associated with the town. As the Boards approached the 100 per cent farm electrification figure they must ensure that the services of men specialised in this work continued to be used to the utmost advantage, and he thought that their skill might be directed towards increasing the average farm's annual consumption to 25,000 or 30,000 kWh.

A toast to "The Guests" was proposed by Mr. N. F. Marsh, chairman of the E.M.E.B., to which the response was made by Mr. J. Rhys Thomas, vice-president of the National Farmers' Union.

Sixty Years of Public Supply in Plymouth

An electrical exhibition to mark the sixtieth anniversary of the provision of the first public electricity supply in Plymouth was opened at the Abbey Hall on 21st October. The outstanding feature of the exhibition was its modern presentation in panels, typography, lighting, décor, models, and enlarged photographs which spotlighted "prestige" and sales points. The domestic appliance display covered electric cooking, water heating, home laundry and space heating,



A 60 MW hydrogen-cooled turbo-generator being installed at the Elland (Yorkshire) power station of the C.E.G.B. It is the third to be supplied to Elland by the Trafford Park Works of the A.E.I. Turbine-Generator Division. This machine is the fiftieth hydrogen-cooled turbo-generator produced at the Trafford Park Works

a special section being devoted to electric floor warming. Models were shown of the Hinkley Point and Berkeley nuclear power stations; the remotely controlled power station which the South Western Electricity Board is installing at Princetown (Devon); and a complete electricity transmission and distribution system.

The Lord Mayor (Councillor P. N. Washbourn) opened the exhibition by pressing a table switch illuminating the stands. He then read congratulatory telegrams from the citizens of Plymouth (Massachusetts); from Mr. C. R. King (chairman, Electricity Council); Mr. A. N. Irens (chairman, South Western Electricity Board); and Mr. A. C. Thirtle (regional director, Central Electricity Generating Board).

Mr. E. A. Newburn, group adviser to the Board, said that in 1899 there were only 82 consumers connected to the mains in Plymouth. Today there were 94,100. Plymouth was served by just over 700 miles of mains and by many hundreds of well-equipped sub-stations.

The Lord Mayor of Plymouth opens the diamond jubilee electrical exhibition. Left to right: Mr. W. A. Brimacombe, part-time member, South Western Electricity Board; Miss Joan Vickers, M.P. for Devonport; the Lord Mayor; Mr. E. A. Newburn, group adviser and manager, Plymouth District; and the Lady Mayoress

Liverpool Lighting Inspection

Cities the size of Liverpool should have a specialist electrical department with its electrical engineer. This view was expressed by Alderman Hugh Carr, chairman of the Liverpool Corporation Lighting Committee, at a dinner following the Committee's annual inspection of the city lighting. In the old days, he said, Liverpool had its city electrical engineer to whom all electrical problems of any magnitude were referred. Even now, with generation and distribution nationalised, there were still many Corporation problems which required the advice of the specialist. The Lighting Committee's work for the Mersey Tunnel was of considerable magnitude, particularly as the equipment was over 25 years old. Three major problems with which the lighting engineer was now concerned were the complete re-lighting of the tunnel at a cost of approximately £11,000; modified ventilation operation which might well save the Committee several thousands of pounds per annum; and the complete renewal of power and control cables which might cost as much as £100,000.

After giving examples of the Department's special electrical services, Ald. Carr pointed out there were fields in which the full potential of the Department was not being used.

Appreciation of the work of Mr. C. C. Smith, city lighting engineer, and his staff was expressed by Ald. F. Keating, deputy chairman of the Lighting Committee.

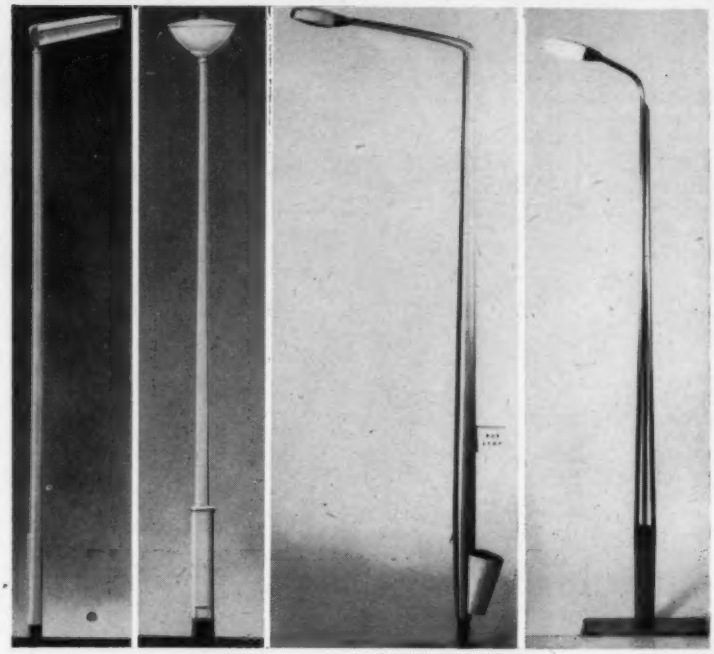
OVERSEAS

Plant for Tanganyika

An extension to the Kurasini power station, Dar es Salaam, of the Tanganyika Electric Supply Co., Ltd., will be completed at the end of this year with the commissioning of new generating plant in one unit to give an increased output of 2,200 kW. The plant now being built and installed by Harland & Wolff, Ltd., includes a TR5 type 3,340 b.h.p. at 231 r.p.m. two-stroke opposed piston engine to operate on diesel fuel oil. The alternator, of 2,837·5 kVA, is directly coupled and generates at 3·3 kV, being controlled through a step-up transformer and 11 kV switchgear manufactured by the New Switchgear Construction Co., Ltd., to suit the existing equipment of the station. The new machine, together with three similar sets all installed since 1953 and six smaller generating units, will provide the station with a total capacity of 13,910 kW to meet the Tanganyika capital's increasing requirements of electricity.

During the ten years from 1948 the maximum demand for the area has risen from 2,000 to 9,000 kW and the yearly output of electricity from 7·5 million to 35·6 million kWh.

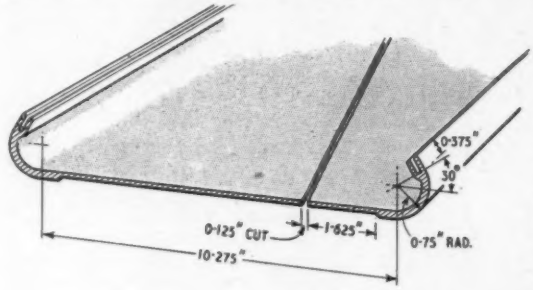
Aluminium Street Lighting Columns

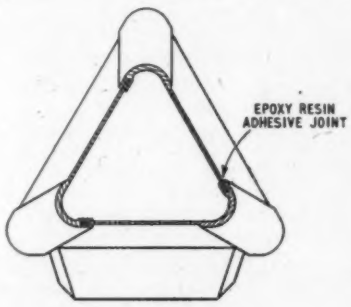


Prize-winning designs in the A.D.A. street lighting column competition. Left to right: Entries 1A, 1B, 25 and 33

AT the Royal Society of Arts on 21st October awards were made to the prize-winners of the aluminium street lighting column competition organised by the Aluminium Development Association. In addition to prize-winners and other entrants, the ceremony was attended by a large number of architects, designers, structural engineers and street lighting specialists. The awards were as follows:—First prize, entries 1A and 1B (£250), to Mr. J. Howe, F.R.I.B.A., F.S.I.A. (design consultant to the A.E.I. Lamp & Lighting Co., Ltd.), in conjunction with Reynolds T.I. Aluminium, Ltd., and Mr. J. B. Dwight, M.A., M.Sc., A.M.I.Mech.E. (member of the Civil Engineering Department, University of Birmingham). Second and third prizes combined (£150), divided equally between: Mr. F. J. B. Rowley (student), College of Art and Industrial Design, Newcastle-upon-Tyne (entry 25), and Mr. S. L. Devlin (student), Royal College of Art, London, S.W.7 (entry 33). A students' prize (£75) was divided equally between Mr. S. L. Devlin and Mr. F. J. B. Rowley. The panel of assessors was the Hon. Lionel Brett, M.A., F.R.I.B.A. (nominated by the president of the Royal Institute of British Architects), Professor Sir Alfred Pugsley, O.B.E., F.R.S. (past-president of the Institution of Structural Engineers), and Sir Gordon Russell, C.B.E. (director, the Council of Industrial Design).

The A.E.I. designs which obtained the first prize were for a 25ft column for Group A lighting schemes and a 15ft Group B column which is already in production. In both cases the column has a tapered triangular cross-section. The shaft is fabricated from HEG-WP aluminium alloy extrusions with 60° inclined flanges, the edges of which are slotted as shown in the diagram. The channel sections are cut diagonally into two pieces from one length to the other; and the six pieces from three extrusions enable two columns to be fabricated.





Fabrication is simple and is done by interlocking the cut extrusions together. The shaft taper is produced by the diagonal cut and the assembly of three sections with their wider ends together. Mechanical strength is obtained by using an epoxy-resin adhesive of the cold setting type to bond the joint between the slotted flange of the extrusion and the inserted taper-cut part of the web. The 25ft column is fabricated in one piece approximately 28ft 6in long from spigot to base plate. The gear chamber projects slightly and is made from aluminium sheet welded to form a rigid tray-like compartment. The 15ft column is made in two parts, the tapered part terminating in a die-cast base cap some 3ft above ground level where it is joined to the parallel sided gear chamber.

Marconi Mobile Showroom

The new mobile demonstration unit of Marconi Instruments, Ltd., is now making a tour of the South of England. The main display section of the showroom houses a comprehensive selection of the company's electronic measuring instruments, which can be demonstrated either in the caravan or on the factory bench; these include oscilloscopes, electronic counters and other specialised equipments.

Following its present tour, the demonstration unit will visit instrument users in the North of England and it is planned to send it to major industrial centres on the Continent, starting with a four-month tour of Western Europe next year.

INDUSTRIAL NEWS

Power Station Construction Consortium

As we reported in our last issue, a new consortium has been established with the title of Power Construction, Ltd., to design, manufacture, deliver and construct power stations in any part of the world. The members of the consortium are:—The Armfield Hydraulic Engineering Co., Ltd., Belliss & Morcom, Ltd., Cory Brothers & Co., Ltd. (a member of the Powell Duffryn Group), Lancashire Dynamo Holdings, Ltd., and the Mitchell Engineering Group, Ltd. The range of experience and the facilities of its members enables the consortium to offer a comprehensive and completely integrated service embracing all stages from the planning to the commissioning of power stations. Through the combined organisations of its members the consortium has representation in most parts of the world.

The consortium offers generating sets and compressors in the following ranges:—Turbo-alternators, up to 15,000 kW; steam engine driven alternators, up to 900 h.p.; diesel engine driven alternators, 120-2,000 h.p.; dual fuel engine driven alternators, 120-2,000 h.p.; Pelton wheels, up to 5,000 h.p.; Francis turbines, up to 5,000 h.p.; propeller turbines, up to 1,000 h.p.; Kaplan turbines, up to 500 h.p.; and air and gas compressors, up to 12,000 c.f.m. at 120 p.s.i. (lower capacities up to 7,000 p.s.i.).

In addition to the generating sets themselves the consortium offers advice on the selection of the most suitable type of power station, the preparation of specifications when required, site investigation, inspection and progressing during manufacture, shipping and insurance services, erection on site including civil works, and acceptance testing. The address of the consortium is Power Construction, Ltd., 19, Berkeley Street, London, W.1 (telephone: Grosvenor 3801/9).

Electricity Board Scholarships

The South Western Electricity Board is this year offering up to three university scholarships open to boys and girls, aged from 17 to 21, to study to become electrical engineers. The scholarships are for three years and are worth £450 a year at Oxford or Cambridge, and £400 a year at other universities. The successful candidates will be expected to train with the electricity supply industry before going up to the university, and to return to the industry for at least two years after taking their degree.

New DoRDeC Member

R. & A. Main, Ltd., has been elected to membership of the Domestic Refrigeration Development Committee. There are now ten members of DoRDeC, which is representative of the leading domestic refrigerator manufacturers in this country and is responsible for the public relations and promotion of the domestic refrigeration industry.

London Electric Wire Co.'s Liverpool Branch

The London Electric Wire Co. & Smiths, Ltd., and its associate companies, Frederick Smith & Co., the Liverpool Electric Cable Co., Ltd., Vactite Wire Co., Ltd., Millett Levens (Engravers), Ltd., and Printed Circuits, Ltd., have opened new and larger branch premises at 16-28, Vernon Street, Liverpool. The opening ceremony, symbolised by the raising of the electrically operated loading bay shutter, was performed by Mr. K. W. Marten, sales director of the L.E.W. group of companies. The new building, which has a floor area of nearly 7,000 sq ft, will enable a greatly increased stock, covering a comprehensive range of products, to be held at the branch. The telephone number (Central 6808) is unchanged.

The new Liverpool branch premises of the London Electric Wire Co. & Smiths, Ltd., and associate companies

Electricity Supply Workers' Wages

On Thursday last week fifty maintenance men at Bankside power station commenced an unofficial overtime ban as a protest against the "delay" in replying to the electricity supply workers' claim for a 40-hour week. Similar action was taken by about 110 maintenance workers at Bow power station on Monday. A spokesman for the C.E.G.B. stated that the ban was not expected to affect public supplies.

The overtime ban followed a meeting of the Negotiating Committee of the N.J.I.C. for the Electricity Supply Industry on the previous day at which a reply was expected to the men's claim for a reduction from 44 to 40 hours in the working week and a third week's holiday with pay. A statement issued by the Electricity Council said that there appeared to be some misunderstanding as to the exact nature of this meeting. It was a meeting of the Negotiating Committee which had no power to act but had power to make recommendations to the full Council on matters which it was authorised to examine. It was mentioned that the next meeting of the Committee was to be held on 18th November and that the full Council was to meet on the following day. Discussion also took place regarding the claim for an additional week's holiday with pay, but no agreement was reached.

Marconi Indian Agreement

Marconi's Wireless Telegraph Co., Ltd., has announced that an agreement has been concluded between the company and the Government of India (Ministry of Defence) for the manufacture under licence in India of Marconi v.h.f. multi-channel radio terminals and repeaters, and ancillary equipment. Under the terms of the agreement Marconi's are to supply all necessary technical assistance for indigenous manufacture.

Mobile Fan Exhibition

On 13th October a mobile fan exhibition by Woods of Colchester, Ltd., left Harwich for a 3,000-mile tour of Belgium, Holland, Luxembourg and France. This is its third visit to Europe since 1955. Housed in a specially-built coach, the exhibition shows the whole range of the company's products—"Aerofoil" fans, propeller fans, heat exchangers, roof

Woods of Colchester mobile fan exhibition

extract units and the "Xpelair" range, including the recently-introduced 12in fan. The present tour opens in Belgium with visits to shipping and shipbuilding firms in the Antwerp area.

Diesel Engine Company's Extension

An extension which will cost £285,000 is announced by F. Perkins, Ltd., Peterborough, to enable a major reorganisation of the main factory to be carried out. It will include the erection of three extra bays at the company's Eastfield factory. The plan is linked with a development scheme, involving additional plant, equipment and material handling facilities. Work is to start soon and will be completed by the middle of 1960.

Aerial Exhibition

A selection of television aerials was shown at a recent three-day exhibition at Cambridge organised by Labgear, Ltd., and the quality of reception which could be obtained from some of the transmitters serving that area was demonstrated. Signals have previously been received on bands 1 and 9 from London and also on band 1 from Norwich, and new stations—the B.B.C.'s channel 5 at Peterborough and the 200 kW channel 11 transmitter at Mendlesham—now serve the area. One of the aerials on display was the new double diamond unit intended for Anglian I.T.V. reception and, when used in conjunction with the model C.N.911 diplexer, the extra programme can be received without the need of a further down-lead.

"Exide" Motor Show Luncheon

Mr. A. W. Browne, O.B.E., M.I.E.E., chairman of Chloride Batteries, Ltd., presided at the company's annual Motor Show luncheon at the Clarendon Restaurant, Hammersmith, on 21st October. In a speech introducing the toast "The Press and Guests," Mr. Browne said that the company was spending more and more on research and new laboratories with an area of 40,000 sq ft and 180 members of staff were to be officially opened early next year. It was quite untrue that there had been no improvement in the lead-acid battery since its introduction. There had been an enormous improvement in the power/weight ratio and in the life of batteries. Although the lead-acid battery had a rival in the alkaline battery the latter had much the same power/weight ratio. Other types were usually of the "one-shot" variety, giving a greater efficiency for a short period.

The toast was replied to by Mr. Alex Bruce (chairman, Guild of Motoring Writers) for the Press and Mr. G. E. Liardet (chairman and managing director, Simms Motor & Electronics Corporation, Ltd.) for the other guests.

Marine Semiconductor Rectifiers

Germanium rectifier equipments ranging in size from a few kW to over 18 MW have been put into service over the past five years by Associated Electrical Industries' Heavy Plant Division. A large semiconductor rectifier equipment has now been produced for marine use where the advantage of this static conversion is particularly attractive.

Two germanium rectifiers, each rated at 255 kW, 225 V, 1,136 A, have been supplied recently to the Admiralty for installation in H.M.S. *Mull of Kintyre*, a maintenance ship with a 440 V three-phase, 60 c/s main supply system. The rectifiers will be used for providing d.c. power to other ships lying alongside. The equipment contains several features, such as the need to meet Admiralty shock requirements and the inclusion of an air cooler with a sea water pump within the cubicle.

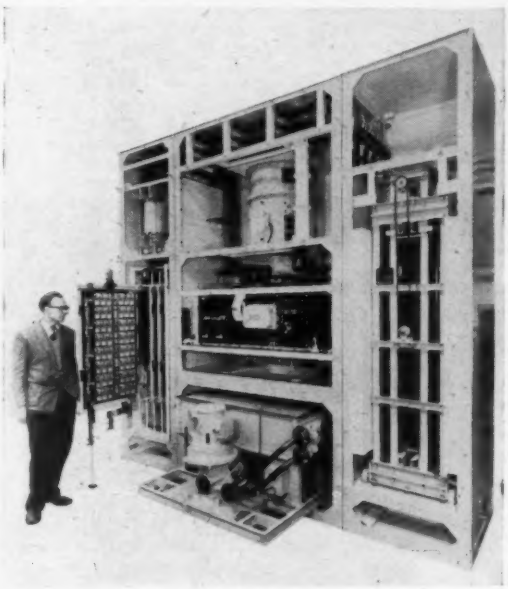
The rectifier is required to give a d.c. output of 225 V ±2 per cent at any load and over the range of a.c. supply voltage fluctuations. This voltage control is obtained automatically by the use of a d.c. voltage relay connected across the output terminals. The relay controls a pair of reversing contactors in the supply to the driving motor of the stepless voltage regulator. The rectifier is a delta-connected auto-transformer with moving contacts. The output of the voltage regulator is connected to the primary of a buck and boost transformer, the secondary of which is connected in series with the secondary output of the main rectifier transformer.

In most marine applications, automatic voltage control should not be necessary unless there are wide variations in the a.c. supply voltage in addition to inherent d.c. regulation of the rectifier.

St. Albans Automatic Telephone Exchange

A new automatic telephone exchange was put into service on 8th October by the Post Office at St. Albans, Herts. Manufactured and installed by Standard Telephones & Cables, Ltd., it is equipped to cater for about 8,500 subscribers' connections initially, with an ultimate capacity of 14,000 subscribers' connections. Most of the equipment has been manufactured at the New Southgate Works of S.T.C., and comprises automatic switches and racks of the latest Post Office "Non-Director" type, with an associated manual switchboard of 26 operators' positions to cater for incoming and outgoing telephone traffic which can-

The A.E.I. 255 kW semiconductor rectifier cubicle. Rectifier trays are shown on the left, the transformer is in the centre, with the fan above. The air-cooling equipment and the voltage regulator are on the right



not be dialled. In addition, there will be six inquiry positions and one supervisor's position.

Cable Works to Close

It has been decided to close the Bootle works of the Liverpool Electric Cable Co. The company states that the decision is part of an operation being carried out in the Associated Electrical Industries group to rationalise electric cable-making interests. About 500 workers would become redundant, but dismissals would probably not start before Christmas and would be spread over a period. The factory would be retained for an alternative product at some future date.

"Efco Journal"

As a means of communication between the companies' engineers and metallurgists and metal-working companies Efco, Ltd., and its subsidiaries have produced a new periodical publication, the "Efco Journal." Among the illustrated articles appearing in the first number are those on some recent heat-treatment developments, the work of the new Efco Foundry Division (which makes various machines used in casting), the new Sulzer foundry at Winterthur (Switzerland) which is equipped with Efco furnaces, and an account of the stress relieving of the No. 1 reactor vessel at the Berkeley nuclear power station.

Yorkshire Board's Travelling Exhibition

The exhibition trailer, shown in the accompanying picture, has been completely rebuilt by the Spenborough Engineering Co., Heckmondwike, in aluminium alloy and fibreglass to the specification of the Yorkshire Electricity Board, Scarcroft. It is to be used for practical demonstrations of domestic electrical equipment. The trailer is 21ft 6in long by 7ft 6in wide in the closed position and 34ft long by 14ft wide when fully extended. This has been achieved by hinging one side and both ends of the main structure to form a floor and roof canopy when fully erected. The whole of the floor is in positive grip aluminium plate, the roof extensions and main roof section being covered with clear fibreglass panels to improve the natural lighting. Stability on site is afforded by the use of hydraulic jacks fitted to the trailer frame which are capable of independent adjustment from control valves under the main floor. The extension floors are supported by screw jacks with quick acting bayonet fittings for speed and safety of erection. The whole trailer has been decorated and lettered to the Y.E.B. specification and the final effect is improved by the use of a detachable striped canopy with matching valances.

Planned Maintenance Scheme

Lancashire Dynamo Electronic Products, Ltd., Rugeley, Staffs., announces that it has introduced a planned maintenance scheme for customers in the United Kingdom. The scheme, which will be operated by the Service and Field Operations Department, involves four visits per annum and will be undertaken on a two-year contract basis with annual payments.

Price Reductions

Hoover, Ltd., has announced that as from 26th October the price of the "Constellation" spherical vacuum cleaner is reduced from £27 8s 6d to £18 (tax paid), a reduction of more than a third. Similarly, four Hoover wringer type washing machines are reduced by an average of £6 15s each.

The prices of the "Hoovermatic" combined washing machine/spin dryer and the company's recently announced upright cleaners remain unaltered.

As from Monday next, Mullard 21in radiant screen TV tubes will be reduced from £18 to £16. The prices of the 17in and 14in tubes will be unchanged.

The range of miniature fluorescent lamp starters (type K.3001 and K.3002) of Philips Electrical, Ltd., has been reduced in price from 3s 3d to 2s 9d.

Works Visits

Members of the Council of British Manufacturers of Petroleum Equipment, led by Mr. G. V. Sims, director, recently paid a visit to the offices and works of Evershed & Vignoles, Ltd., Chiswick, and were welcomed by the joint managing director, Mr. D. D. Walker, and by Mr. W. T. Marchment, manager of the Instrument Division. The object of the visit was to inspect a large oil refinery control panel designed to control two crude distillation plants, a hydrofiner, a catalytic reformer, and a redistillation unit. This involves the provision of one hundred and twenty separate control loops each embodying an Evershed Mark IV controller, with associated transmitters and positioners as control elements. After being entertained to lunch the visitors made a tour of the works.

German scientists recently visited Plessey Nucleonics, Ltd., at Northampton, for initial acceptance tests on the burst slug detection equipment ordered for the water-cooled nuclear reactor being built at Karlsruhe in Western Germany.

Computer for Russia

The Russian Government has placed an order for a National-Elliott 802 computer. It was recently announced that substantial orders for National-Elliott 802 and 803 computers had also been received from the United States. Elliott-Automation, Ltd., states that it is the first company to announce sales of computers both to Russia and to the United States.

Hydraulic Equipment Association

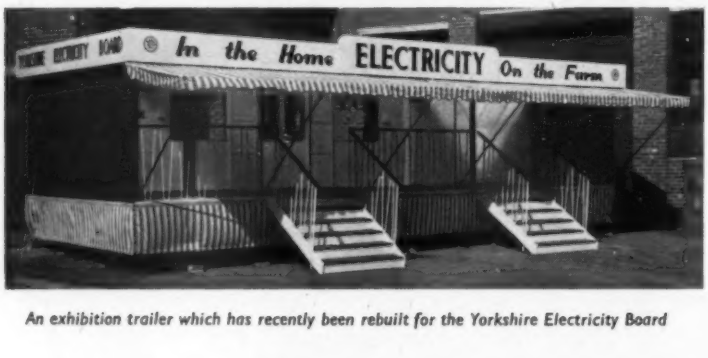
British hydraulic equipment manufacturers have now formed their own association with the title of the Association of Hydraulic Equipment Manufacturers. Its offices are at 38-40, Eccleston Square, London, S.W.1 (telephone: Victoria 0855).

Mobile Demonstration Unit

A new mobile demonstration unit equipped with a comprehensive range of recording instruments of Southern Instruments, Ltd., starts its first journey on 2nd November. Mr. J. F. Orr and Mr. P. Linscott are in charge of this unit which, with the co-operation of the company's Scottish agents, Elesco Electronics, Ltd., will be visiting various industrial and Government establishments in Scotland.

New Hungerford Factory

Last Friday a new factory for Chilton Electric Products, Ltd., built entirely by the company's own building department, was officially opened at Hungerford, Berks. As switchgear manufacturers, the company have understandably made a feature of the electrical installation and it has been built without a single fuse—the Chilton "Protector" circuit-breakers having been used throughout. The origin of Chilton dates back to 1936 when Mr. A. R. Ward, the present chairman, founded the Chilton Aircraft Co. After the war the manufacture of aeroplanes was discontinued and it was then that Chilton entered the field of light engineering and electrical products. Early items to be produced included electric shavers, circuit-breakers and earth leakage trips which form the basis of



An exhibition trailer which has recently been rebuilt for the Yorkshire Electricity Board

Chilton Electric Products' new factory at Hungerford, Berks.

the company's present range. In 1949 Chilton Aircraft founded its own selling company (Chilton Electric Products) and since then the companies have steadily developed until, within the last year or two, the need for more office accommodation and factory space became acute.

The new building occupies an area of just over 20,000 sq ft and consists of a single-storey factory area and adjoining two-storey office block. The factory space is divided into a main assembly area, light machine shop, tool room and stores, where altogether nearly two hundred employees are able to work in light and congenial surroundings. At the edge of the new factory site is the development department which includes a test laboratory, drawing offices, tool rooms, etc. Also in this building there is a short-circuit test laboratory where all circuit-breakers are submitted to a 1,800 A test. Although the factory is now complete and has taken over the manufacture of all Chilton products, which include earth leakage trips, "Protector" and "Atlas" miniature circuit-breakers, switchboards and panels, universal shaver sockets, hair clippers, "Acculux" re-chargeable torches, spin dryers and "Sportsman" shavers, there are future plans for development of the surrounding area. The latest additions to the company's business are the agencies for Kraus & Naimer rotary switches (including a 36-position model) and the American "Copperweld" earthing rods. All these products are sold throughout Great Britain and, in addition, an export department receives orders from all over the world.

Orders for Water Turbines

Boving & Co., Ltd., has recently been awarded two contracts for water turbines and associated equipment, one in Australia and the other in New Zealand. The first is for the underground Barron Gorge power station of the State Electricity Commission of Queensland and comprises two Francis turbines, each to develop 47,000 h.p. at a head of 939ft. The contract also includes pressure relief valves and 48in diameter inlet valves of the Boving rotary type. The second contract is for a 4,000 h.p. 210ft head Francis turbine to be installed at Kuratau power station by the King Country Electric Power Board. The turbine inlet valve and two automatic self-closing butterfly valves for protection of the pipeline have also been ordered from Boving & Co. A substantial portion of both contracts will be manufactured in Australia and New Zealand respectively, the remainder being made in the United Kingdom. The value of the two orders amounts to approximately £250,000.

Valve Replacement Index

The "Valve Replacement Index" published by the English Electric Valve Co., Ltd., lists valves of various manufacturers for which E.E.V. valves may be used as replacements. Service type numbers are also listed. In most cases direct replacement can be made, but an indication is given where some minor adjustment to the circuit may be necessary. Copies of the index and detailed data for any E.E.V. type valve will be forwarded on request by the Technical Publications Department, English Electric Valve Co., Ltd., Chelmsford, Essex.

Hoover London Showroom

The London showroom of Hoover, Ltd., at 213, Regent Street, W, has recently been re-opened after being completely remodelled and redecorated throughout. The design was by Mr. M. H. Armengol to a conception of Mr. G. D. McKenzie, Hoover, Ltd.'s, display and exhibition manager.

The new showroom has been designed so that not only can the products be seen in the window but also that the interior displays can be seen from the street. These are confined to one wall providing for flexible presentation of the products. The rest of the showroom is left free for customer reception. A demonstration kitchen used for individual demonstrations is behind screens.

British Exhibition in New York

The Engineering Centre, Birmingham, is to support the British Exhibition to be held in New York from 10th to 26th June next year. Mr. A. J. Cox, general manager, states that he has booked space at the exhibition which will enable between 50 and 60 firms to take advantage of the special facilities the Engineering Centre has to offer and so be able to show their products to American buyers on an economical basis.

Production Engineering Brochure

An illustrated brochure, describing the opportunities available to boys entering the profession of production engineering and entitled "A Career in Production Engineering," has just been published by the Institution of Production Engineers. This booklet will be of interest not only to school leavers and their parents, but also to technical colleges, training officers, youth employment officers and careers masters. Copies may be obtained, free of charge, from the Institution at 10, Chesterfield Street, Mayfair, W.1.

Electric Winders for South Africa

Two contracts for electric winders to the value of £250,000 have recently been received from South Africa by the General Electric Co., Ltd. The winders are for installation at gold mines associated with the Anglo-American Corporation of South Africa, Ltd. The first contract is for the supply of one 4,500 h.p. Blair-type (twin rope) hoist for the President Steyn Gold Mining Co., Ltd. The order for the mechanical parts has been received from the Vanderbijl Engineering Corporation of South Africa, Ltd., and these will be manufactured in South Africa to designs produced at the Erith Engineering Works of the G.E.C. The electrical

The remodelled showroom of Hoover, Ltd., in Regent Street, London

parts have been ordered direct by the President Steyn Gold Mining Co., Ltd., and will be designed and manufactured at the Witton Engineering Works of the G.E.C. This is the second set of electrical equipment for a Blair winder to be ordered from the G.E.C. The first set is already in course of manufacture for the President Brand Gold Mining Co., Ltd.

The second new contract is for the supply of mechanical parts only of two 1,100 h.p. double-drum hoists for Western Deep Levels, Ltd. These hoists will be installed underground to serve No. 2 and No. 3 sub-vertical shafts and will be manufactured in South Africa to the designs of the Erith Engineering Works.

Scottish Company's Trade Show

The Bryterlite Electrical Co. (Glasgow), Ltd., held a special trade show from 19th to 23rd October at its showrooms at 52, Regent Quay, Aberdeen, at which a wide selection of electrical appliances was displayed.

Prices of Materials

In the accompanying table we give the basis prices of the more important materials used in the electrical industry. The figures given are the selling prices and are those quoted on Tuesday last.

ALUMINIUM ingots	ton	£180 0s 0d
COPPER, H.C. Electro	ton	£256 10s 0d
Fire Refined 99·70%	ton	£255 0s 0d
Fire Refined 99·50%	ton	£254 0s 0d
COPPER Tubes ..	lb	2s 5½d
Sheet	ton	£270 0s 0d
H.C. wire and strip..	ton	£312 5s 0d
LEAD, English ..	ton	£71 5s 0d
Foreign	ton	£70 0s 0d
MERCURY	flask	£72 0s 0d
TIN, block (English) ..	ton	£794 0s 0d
ZINC, G.O.B. Foreign	ton	£95 0s 0d
BRASS Tubes (solid drawn)	lb	2s 0½d
Wire	lb	2s 10½d
PHOSPHOR BRONZE Wire	lb	4s 3½d
PLATINUM ..	oz	£28 10s 0d
RUBBER, No. 1 R.S.S. spot	lb	35½d—36d

Cheaper U.S. Generators

The American General Electric Company has announced a new cut of 5 per cent in its published prices for steam turbo-generators of 60 MW and over. Competition from British, Swiss and Italian manufacturers who have regularly underbid United States firms on Government contracts was believed to be the principal factor in the decision. The ruling of the Office of Civil and Defense Mobilisation on the petition of American manufacturers against foreign imports of large steam turbo-generators is still awaited.

Trade Announcements

Philips Electrical, Ltd., announces the following appointments which will become effective on 1st January next. Mr. W. B. Dwyer, radio and TV representative for the E., E.C., N. and N.W. postal districts of London in the company's S.E. Region, will take over responsibility for the sale of car radio and dictation machines throughout the region. He will be succeeded in his present post by Mr. A. F. Potter, who joins the company from Radio & Allied Industries, Ltd. Mr. P. M. Hancock, electrical appliances manager, S.E. Region, will be transferred to the head office as product manager for "Philishave" electric shavers, and Mr. L. G. Bassle, currently handling car radio sales promotion in the S.E., will take over the post of electrical appliances area manager, in place of Mr. Hancock.

Cass Electronics, Ltd., has opened a showroom at its Chertsey works, where it can demonstrate under actual working conditions its "Nira Tele-Tracer" wireless staff paging systems and "Dialog" instant intercom equipment. The telephone number has been changed to Chertsey 3481.

A South Wales area sales office has been established by **Birlec, Ltd.,** at Cardiff. Mr. W. H. Statham, who is appointed area representative for South Wales, has his headquarters at Associated Electrical Industries, Ltd., Mervyn House, Frederick Street, Cardiff (telephone: Cardiff 28511). He was previously sales engineer in the Furnace Division of the company.

With effect from 1st November, **Research & Control Instruments, Ltd.,** has become the sole distributor in the United Kingdom for the industrial products at present marketed by its associated company, Philips Electrical, Ltd. A new division has been set up by R.C.I. for this purpose. All correspondence relating to Philips arc welding supplies, filtration equipment and high frequency heating generators should be addressed to Research & Control Instruments, Ltd., Industrial Products Division, Instrument House, 207, King's Cross Road, London, W.C.1 (telephone: Terminus 2877).

The telephone number of **Allen West & Co., Ltd.,** is now Brighton 66666.

Elliott Brothers (London), Ltd., a member of the Elliott-Automation Group, has moved its branch office in South West England and South Wales to 55, Westgate Chambers, Newport, Mon. (telephone: Newport 65710).

British Insulated Callender's Cables, Ltd., announces that its depot at 58-59, Regent Street, Plymouth, is now an independent branch. Mr. C. E. B. Baker, who has been in charge of the depot since 1945, will continue as branch manager.

The telephone number of **Metway Electrical Industries, Ltd.,** has been changed to Brighton 66433.

A. E. Dees, Ltd., electrical wholesalers, have moved to 3, Queens Square, Newcastle-on-Tyne, 1. The telephone number (Newcastle 25661) is unchanged.

Square D, Ltd., has moved its Birmingham field office to 751, Bristol Road South, Northfield, Birmingham, 31 (telephone: Priory 1163/4).

The telephone number of the **Mining Engineering Co., Ltd.,** has been changed to Worcester 22291.

Institute of Public Supplies

At the recent annual general meeting preceding the conference of the Institute of Public Supplies Officers Dr. F. A. Tatford, D.Litt., director of contracts, United Kingdom Atomic Energy Authority, was elected president of the Institute. In his presidential address he said that the title of the Institute had been altered to the Institute of Public Supplies, and it had started a new chapter in its history. With the change of title there should be a place in the Institute for those interested generally in the subject of public supplies. The field was a specialised one and the Institute was the appropriate body to sponsor research and special studies in that field. From time to time it might be necessary for Treasury or Ministerial consideration to be given to the desirability or otherwise of curtailing or, *per contra*, of encouraging buying and contracting by Government Departments, nationalised bodies and local government. The character of the Institute and its special relationship to such public bodies made it the only suitable organisation competent to tender advice. It should be a natural development for the Institute to be called into consultation on these matters, and even possibly for Government representation on certain of its committees.

Speaking at the conference dinner, Sir Christopher Hinton said that the major problem for the electricity supply industry in the next ten to twelve years was to face the fact that from being a one-fuel economy based on coal, it was now a three-fuel economy based on coal, oil and nuclear fuel. These were competitive fuels and when the present nuclear programme came to an end he would be surprised if a further one was laid down. Whether or not the nuclear fuel industry eventually found itself in the same position as the coal industry today depended entirely, to his mind, on whether they could produce nuclear fuel on a competitive basis. Referring to the supplies officer, Sir Christopher declared that supplies appointments were more and more approaching board room level. With his knowledge of technology, economics and the law the supplies officer had grown to professional status. Success in a public undertaking was coming more and more to depend on how the public supplies officer exercised his initiative in buying and carried out his duties.

PERSONAL AND SOCIAL

News of Men and Women of the Industry

On Thursday last week the Prime Minister announced his final list of Ministerial appointments. The new Minister of Power is **Mr. Richard Wood,** former Parliamentary Secretary, Ministry of Labour. **Mr. J. R. Bevins,** previously Parliamentary Secretary, Ministry of Housing and Local Government, becomes Postmaster General, and **Mr. F. J. Erroll,** former Economic Secretary, Treasury, is appointed Minister of State, Board of Trade. Junior Ministerial appointments include **Mr. J. C. George,** Parliamentary Secretary, Ministry of Power; **Lord Chesham,** Joint Parliamentary Secretary, Ministry of Transport; and **Miss Mervyn Pike,** Assistant Postmaster General.

Mr. R. Wood

The Minister of Power has reappointed the following part-time members of Electricity Boards:—*South Eastern*: **Sir Albert Day,** C.B.E., Haywards Heath, Sussex. *Southern*: **Mr. J. Ryan,** C.B.E., M.C., M.A. (Cantab.), B.Sc., Ealing, London. *South Western*: **Col. T. F. Hood,** C.B.E., T.D., D.L., J.P., F.C.A., Newton St. Loe, near Bath. *Midlands*: **Alderman A. E. Bennett,** J.P., Stoke-on-Trent, and **Mr. S. F. Burman,** C.B.E., Birmingham. *Yorkshire*: **Alderman P. Buchanan,** J.P., Sheffield. *North Western*: **Mr. M. L. Haselden,** B.A., Lostock, nr. Bolton, and **Mr. G. A. Howe,** M.A., LL.B., A.C.A., Lytham St. Annes, Lancs.

The A.E.I. Lamp & Lighting Co., Ltd., has set up a combined Lamp and Lighting Export Department at Melton Road, Leicester, of which **Mr. G. O. Sparks** has been appointed manager. He was previously assistant manager of the company's Commercial Sales (Lighting) Department, a post he had held since December last year. Mr. Sparks joined the Lamp and Lighting Department of the Metropolitan-Vickers Electrical Co., Ltd., in 1935 and was subsequently with the Curtis Lighting Co. and Benjamin Electric, Ltd. He re-joined Metropolitan-Vickers in 1948 and was responsible for its lamp and lighting export trade. On the formation of A.E.I. Lamp & Lighting Co., Ltd., he was appointed to the Lighting Sales Department headquarters. He is a diploma member of the I.E.S.

Mr. G. O. Sparks

Mr. V. J. Speller, formerly education and training officer of the North West, Merseyside and North Wales Region, has been appointed chief assistant public relations officer of the Central Electricity Generating Board in succession to **Mr. P. J. Field,** who was recently appointed public relations officer.

Mr. C. W. A. Priest, B.Sc.(Eng.), A.M.I.Mech.E., M.I.E.E., has been appointed chief design and construction engineer of the Central Electricity Generating Board in succession to **Mr. E. S. Booth,** M.Eng., M.I.Mech.E., M.I.E.E., who, as we have already reported, has recently been appointed a full-time member of the Board.

Mr. C. W. A. Priest

Mr. Priest has been chief project engineer of the Northern Project Group since the formation of these groups by the Board in January, 1958. After service in the 1914-18 war, he took a three-year full-time course in electrical engineering at Portsmouth College and received his training at the Dick Kerr Works of the English Electric Co., Ltd. In 1923 he joined the London Electric Supply Corporation as an assistant engineer at the Deptford power station, where, subsequently, after the station was taken over by the London Power Co., he became turbine house engineer. He was turbine and electrical operating superintendent at Fulham power station for three years until 1939, when he took a post with the Battersea Borough Council as chief assistant engineer, later becoming deputy general manager and engineer. With the reorganisation of the electricity supply industry in 1948 he became generation engineer (construction) of the Southern Division of the then British Electricity Authority and five years later was appointed chief generation engineer (construction) of the South Wales Division.

The annual prizegiving for the apprentices of **Hoover (Electric Motors), Ltd.,** Cambuslang, Lanarkshire, was held recently. These annual prizegivings are held at the Hoover factory groups in England, Scotland and Wales and prizes are given to mark the progress of the young men through their various stages of training. Mr. J. S. McEwan, director of education for Lanarkshire, addressed the boys and presented the prizes. Relatives and friends attended and saw an exhibition of work.

The annual general meeting of the Midlands Branch of the **Electrical Trades' Commercial Travellers' Association** was held at the Crown Hotel, Broad Street, Birmingham, on 12th October. Mr. T. C. Browne, the retiring chairman, in his report paid tribute to the officers, committee and members for their support during the past year, and said that during his year of office there had been a large increase in membership, and it had been possible to donate a record amount to charity. Mr. P. M. King succeeded Mr. Browne in the chair, and other officers are as follows:—Messrs. S. W. Graese (vice-chairman), C. E. Davison (secretary) and G. A. James (treasurer and charity steward).

Alderman Sir William Walker is to be entertained to a civic luncheon on 9th November in celebration of the completion of fifty years as a member of the Manchester City Council. Sir William is a former Lord Mayor of Manchester, past-chairman of the National Joint Industrial Council for the Electricity Supply Industry and a former member of the Central Electricity Board.

Mr. J. C. Simmonds, M.Sc.(Eng.), Ph.D., M.I.E.E., M.I.Mech.E., managing director of Airmec, Ltd., has been appointed managing director of the British Communications Corporation, Ltd., and of the Radio Television Trust, Ltd., of which Airmec is a subsidiary. Dr. Simmonds, who joined Airmec, Ltd., in 1946, was previously with the G.P.O. Radio Branch as an assistant engineer (old style).

Dr. J. C. Simmonds

Mr. T. J. Gilligan, Liverpool manager for the Dictaphone Co., Ltd., since 1955, has been appointed divisional manager and will be responsible for the areas covered by Birmingham, Bristol, Nottingham and London branches. **Mr. B. F. Shubotham,** manager for Ireland since 1945, has been appointed divisional manager and will be responsible for the company's

branches in the Republic and Northern Ireland. Mr. Gilligan is succeeded at Liverpool by **Mr. W. R. Bruce,** who has been a member of the company's branch sales staff since 1953.

Mr. A. Wilcock, A.M.I.E.E., Dip.M.I.E.S., has been appointed assistant director of the British Lighting Council as from 1st November. He joined the E.L.M.A. Lighting Service Bureau in 1951 as regional engineer for the North West of England and North Wales, and has held this position with the British Lighting Council since its formation.

At the annual general meeting of the Domestic Refrigeration Development Committee (DoRDeC) **Mr. E. G. Rowledge** (Pressed Steel Co., Ltd.) was re-elected chairman and **Mr. M. A. Craig** (Electrolux, Ltd.) vice-chairman. The secretary of DoRDeC is **Mr. Claude Simmonds** (C.S. Services, Ltd.).

Mr. W. Cooper has been appointed contracts manager for Dale Electric (Yorkshire), Ltd., and is responsible for estimating and for all contracts appertaining to the manufacture and sales internationally of the company's range of diesel generating equipment. Before joining Dale Electric Mr. Cooper was estimating and contracts sales manager with Pelapone, Ltd., Derby, and previously he was with John Fowler, Ltd., Leeds.

Mr. W. Cooper

Members of the Social and Athletic Club of the Willesden Switchgear Works of **Associated Electrical Industries, Ltd.,** held their annual dance at the Carlton Rooms, Maida Vale, on 23rd October. The event was attended by 450 members and friends.

Mr. P. D. Rush has been appointed publications manager of A. N. Wright & Co., Ltd., Colchester, and **Mr. G. Haffenden** has been appointed assistant publications manager. Mr. Rush was previously a P.R.O. with Crompton Parkinson, Ltd.

Sunbeam Electric, Ltd., announces the appointment of **Mr. F. J. Edmonds** as general manager of merchandising for all Sunbeam products. Educated at Westminster City School and London University, Mr. Edmonds was originally a chemical engineer in the oil industry, and changed in 1934 to the sales side. He had previously been with Electrolux, Ltd., and Remington Rand. He will be based at the Sunbeam company's London office at 14-16, Old Quebec Street, London, W.1.

Mr. F. J. Edmonds

Dr. Kurt Hahn, founder and former headmaster of Gordonstoun School, was guest of honour at the annual dinner of the **B.T.H. Overseas Association,** held recently in the Masonic Hall, Rugby. The dinner was attended by 150 people, including directors, managers, staff and apprentice members, and guests. Many came to Rugby especially for the occasion, a number from abroad. Before the dinner Dr. Hahn was welcomed by the president of the Overseas Association, Mr. G. S. C. Lucas, O.B.E. (director and chief engineer, B.T.H.), and introduced to the committee by their chairman, Mr. W. Spence (manager, plant applications engineering, A.E.I. Heavy Plant Division), who presided at the dinner. Mr. L. Drucquer (director and general manager, A.E.I. Heavy Plant Division) proposed the toast to the guests and Dr. Hahn, in responding, expressed admiration of the B.T.H. sandwich courses in which apprentices combined academic work in university or technical college with practical engineering in industry. Mr. T. Dougherty, a New Zealand graduate apprentice, proposed the toast of the company. He suggested that, in a large company such as the B.T.H., where changes were gradual, graduate apprentices themselves could be asked to make recommendations in their training system. Mr. D. Edmundson (manager, manufacturing, B.T.H.) responded. Mr. C. P. Holder (director and general manager, A.E.I. Transformer Division) proposed the toast of the Association, and Mr. R. G. A. Dimmick (commercial manager, A.E.I. Motor and Control Gear Division) replied.

Mr. R. Linton has been appointed engineer-in-charge of the new television and v.h.f. sound transmitting station of the B.B.C. near Peterborough, which was brought into service on 5th October.

Mr. E. J. Newitt, who joined H. D. Symons & Co., Ltd., in 1950 as chief accountant and was appointed secretary in 1953, has now been elected to the board of the company. **Mr. R. H. Blewitt,** B.Sc., has joined the company as chief engineer.

Mr. R. Carriett, of the G.E.C. service depot, London, has retired after fifty years' service. His early days were spent in the Electro-Medical and Motor Accessories Departments, head office, and with the opening of the Radio Department in 1922 he became the company's first field service engineer.

Mr. R. W. Leng, who writes in this issue on "Vehicle Performance Measurement," served his apprenticeship with the British Thomson-Houston Co., Ltd., in Coventry, and during the war he was commissioned in the Royal Electrical and Mechanical Engineers. Afterwards he resumed his association with the B.T.H. Co. and later went to Armstrong Siddeley Motors, Ltd., as technical assistant to the quality manager, being mainly concerned with methods of non-destructive testing. Mr. Leng later took up a post with Harry Ferguson, Ltd., and in 1954 was appointed to his present position in charge of the electrical and electronics laboratory at the Research Centre of the Ford Motor Co., Ltd., dealing with problems of instrumentation and design and construction of specialised test equipment.

Mr. R. W. Leng

Mr. F. Foulkes has been re-elected general president of the Electrical Trades Union for a further five years.

Mr. G. C. Panes has been appointed London manager of Hopkinsons, Ltd., at 34, Norfolk Street, Strand, W.C.2.

Mr. R. C. Bird, managing director of Petbow, Ltd., and **Mr. M. K. Westlake,** service manager, left on 19th October for a tour of the Middle East. Mr. Bird is expected to return to this

Mr. A. G. O'Neill, chairman (left) and Mr. E. W. Semmens, managing director, with their ladies, at the diamond jubilee dinner of Nalder Bros. & Thompson, Ltd., reported in our last issue

country at the end of next month. **Mr. R. E. Davis,** sales manager, and **Mr. K. Glensy** have left on an extended tour of Central and South America.

Mr. A. F. Neal, B.Sc.(Eng.), A.M.I.E.E., M.Inst.T., general manager of the Manchester Corporation Transport Department, has been elected president of the Municipal Passenger Transport Association.

The P. & B. Engineering Co., Ltd., has appointed **Mr. J. W. Bryan,** A.M.I.E.E., as its technical representative in the Midlands and South Wales. He succeeds **Mr. W. F. N. Harper,** Associate I.E.E., who is retiring after representing the company for many years. Mr. Bryan served his electrical apprenticeship with Anderson Boyes & Co., Ltd., and was subsequently employed by the English Electric Co., Ltd., and the Clyde Valley Electrical Power Co. He continued to serve the former South West Scotland Electricity Board in the Lanarkshire Sub-Area and has more recently been a technical sales engineer with the Belmos Co., Ltd.

Mr. J. W. Bryan

Mr. A. Neave, M.P., has been appointed to the main board of directors of John Thompson, Ltd., and he will direct the London affairs of the John Thompson group.

Mr. A. Kirkham has resigned from the board of directors of Sir W. H. Bailey & Co., Ltd., and has joined the Foundries Division of David Brown (Industries), Ltd., Penistone.

Mr. H. Glover has been appointed Midlands area sales manager for Dowding & Mills, Ltd.

Mr. E. Hobday, manager of the Liverpool branch of Hirst, Ibbetson & Taylor, Ltd., has been appointed to the board of directors.

Mr. E. Hobday

Mr. A. G. Shaw, formerly senior Midland area representative of Uddeholm, Ltd., has been appointed Midland area manager of the company and will be responsible throughout the area for sales and service in the tool steel and heat treatment divisions.

At the annual dinner of the **Simms Motor & Electronics Corporation, Ltd.,** held at the Simms' Liardet Hall, East Finchley, on 19th October, Mr. G. E. Liardet, chairman, in the course of his speech referred to labour and profits earning and distribution, and said that while increased effort on the part of the individual should be recognised by increased earnings, the benefit arising from increased productivity by improved design, better methods, the installation of new and costly machine tools, better management, and the utilisation of increased capital should be devoted to reducing prices.

Mr. R. A. Gilbey, A.M.I.P.E., has been appointed general manager of the Amersham Works of Dewhurst & Partner, Ltd. He was formerly works superintendent with the G.E.C., Perivale, before which he was production manager with Sterling Engineering, Ltd. **Mr. E. Ford,** who has been with the company for eleven years and was formerly north east area manager, has been appointed northern regional manager. He will operate from the Newcastle office.

Mr. D. K. Fraser, M.I.Mech.E., M.I.Mar.E., at present managing director of Petters, Ltd., is joining the board of G. A. Harvey & Co. (London), Ltd., in the near future.

Mr. J. Fletcher, C.B.E., and **Mr. H. C. Baker,** O.B.E., have been appointed to the court of directors of Cable & Wireless, Ltd.

Mr. Fletcher, who took office on 1st October, is a former general secretary of the Printing and Kindred Trades Federation. He succeeds **Mr. C. N. Gallie,** who did not seek re-election at the company's annual meeting in July. Mr. Baker is the company's divisional manager, Far East. He will join the court on 1st March next year following his retirement from his present post.

C.A.V., Ltd., announce the appointment of **Mr. A. E. W. Austen,** B.Sc., Ph.D., A.M.I.E.E., F.Inst.P., as chief engineer of the company. **Mr. W. E. W. Nicholls,** B.Sc., has been appointed chief engineer for overseas operations.

The annual dinner and dance of **Collins Electrical, Ltd.,** was held at the Ardington Rooms, Clapham Junction, last Friday, and was well attended by members of the staff and guests of the company, including the managers and staff of the Southall and Islington branches. Following usual practice, speeches were kept to the minimum and, apart from the loyal toast proposed by the chairman, Mr. C. E. Collins (chairman and managing director), the only other toast was that of "Our Friends" proposed by Mr. H. Mills and responded to by Mr. J. Ward. Following the short speeches the opportunity was taken to present cheques to four members of the staff who have completed forty or more years of service. A fifth recipient was unable to be present. Later the company enjoyed an excellent cabaret, followed by dancing.

Well over 400 members and their guests attended this year's annual dinner of the **Birmingham Electric Club** held recently at the Grand Hotel, Birmingham. The Lord Mayor of Birmingham proposed the toast of the Club and Mr. R. Patterson, the president, responded briefly. Mr. R. H. Phillips, senior vice-president, then proposed a toast to the guests, after which an amusing response was made by Mr. W. H. McFadzean, chairman and managing director of British Insulated Callender's Cables, and also president of the Federation of British Industries.

OBITUARY

Mr. F. W. Leake.—The death occurred on 14th October of Mr. F. W. Leake, M.I.E.E., for many years with British Insulated Callender's Cables, Ltd.

Mr. Leake joined British Insulated Cables, Ltd., in India in 1923, after serving with Crompton Parkinson, Ltd., in Ireland and India. He later became manager, and subsequently chairman, of the Indian Cable Co. After returning to the United Kingdom in 1937 he held positions with British Insulated Cables and B.I.C.C. From 1956 until his death he was sales manager (works administration), undertaking special duties for the director (home operations).

During the war Mr. Leake was a member of the Sir Alexander Roger Mission to India and the Far East to study wartime cable production in those areas.

Mr. W. C. G. Hardy, formerly with Isenthal & Co., Ltd., died on 22nd October. Mr. Hardy retired in May last year after thirty-seven years with the company, which he joined as a designer. In 1927 the Isenthal Co. became a subsidiary of the Dubilier Condenser Co. (1925), Ltd., and Mr. Hardy became manager of the Isenthal side, a position which he held until his retirement.

Mr. W. Lawson.—The death has occurred, at the age of eighty-four, of Mr. Walter Lawson, former head of the Meter and Motor Department of the Birmingham Corporation Electric Supply Department. Mr. Lawson joined the Birmingham Corporation in 1901 and was special technical assistant to the city electrical engineer for some years before becoming head of the Meter and Motor Department. He retired in 1937.

Mr. J. T. Bates.—The death occurred on 18th October of Mr. Joseph Thomas Bates, of Stapenhill, Burton-on-Trent, a member of the Electrical Contractors' Association.

Mr. Thomas Sutton Gamble, who for the past twenty-five years had represented Flinders (Wholesale), Ltd., in West Norfolk, Cambridgeshire and Lincolnshire, died on 23rd October at the age of fifty.

Mr. W. S. Whiteside.—The death has occurred of Mr. W. S. Whiteside, superintendent of North Tees "A," "B" and "C" power stations.

Mr. R. A. Rogers.—The death occurred on 25th October of Mr. Robert Arnold Rogers, B.Sc., A.M.I.E.E., of Harrow.

Financial Section

STOCKS and SHARES

SOME irregularity has begun to appear among price movements in the industrial markets of the Stock Exchange, and demand has become noticeably more selective than was the case during the first flush of excitement over the Election. Nevertheless, in still very active market conditions, the buyers have for most of the time been maintaining their ascendancy over the profit-takers. Not all the recent company news has been on the side of the bulls. A reduction in the Babcock & Wilcox interim dividend for the current year produced a tremor in the heavy engineering sectors, which had received a month earlier another indication of trading conditions through a similar decision by John Thompson. Both companies, however, reported signs of improved orders in recent months. Elsewhere, shares connected with the motor-car industry have been especially conspicuous.

Motor Accessories

The holding of the Motor Show comes as a reminder that two of the principal suppliers of accessories to the industry, J. Lucas (Industries) and S. Smith & Sons (England), ended their financial years last July and may be expected to announce the results, together with final dividend declarations, within a week or so. Shares of both companies have been particularly strongly supported of late. Lucas £1 shares at 66s 3d stand some 11s above their pre-Election price and more than £1 above their value in the early part of the year. A very considerable expansion in profits was reported a year ago, when the dividend for 1957–58 was raised, effectively, from 7½ to 10 per cent. Earnings were equivalent to 38 per cent on the ordinary capital, which was shown in the balance sheet to be backed by reserves about half as large again. The interim dividend for the latest period was unchanged at 2½ per cent.

S. Smith & Sons

In the case of the 4s shares of S. Smith & Sons (England) the rise in price has been even more striking, for the recent quotation of 21s compares with a figure of 12s at the beginning of this year. For 1957–58 the company paid dividends (including a special interim) totalling 12½ per cent on capital increased by a 100 per cent scrip issue; this represented an improvement of 2½ per cent and was covered almost four times over by the distributable surplus of profits. On that basis the yield on the shares is less than 2½ per cent, but there was an increase in the interim payment for 1958–59 from 3½ to 4½ per cent. At the beginning of this period the company was budgeting for a profit at about the same level as before. The final dividend declaration is expected next Wednesday (4th November).

Simms Motor & Electronics

Other popular investments in the field of motor-car and commercial vehicle components include the 5s

Price Changes in

Company or Board	Nom. Value	Middle price 26th Oct.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield %	1959 Highest	1959 Lowest
Gilt-edged Stocks						£ s d		
Brit. Elec. 1968/73	100	80	+¼	3	3	3 15 0	80¼	77½
Brit. Elec. 1974/77	100	76½	+½	3	3	3 18 6	77	74½
Brit. Elec. 1976/79	100	80	+1	3½	3½	4 7 6	80½	77½
Brit. Elec. 1974/79	100	90½	+1	4½	4½	4 14 0	91	87½
Overseas Electric Supply								
Calcutta Elec.	£1	19/6		6·8†	7†	11 15 0	19/6	16/-
East African Power	£1	20/-		7½	8	8 0 0	22/3	19/3
Nigerian Elec.	£1	14/6		8	8	11 0 9	15/-	13/-
Perak Hydro-Elec.	£1	15/-	+6d	12½	10	13 6 9	15/-	12/3
Electrical Shares								
Aberdare Holdings	5/-	18/9	+6d	17½	17½	4 13 3	18/9	15/6
Aerialite	1/-	10/6		51½	54	5 2 9	10/6	7/9
Allen, W. H.	£1	53/3	+9d	11	12	4 10 3	53/3	43/-
Allied Insulators	5/-	23/6	+2/6	—	20‡	4 5 0	23/6	18/9
Anglo-Portuguese Tel.	£1	30/-	−6d	9	9	6 0 0	30/9	26/6
Aron Elec. Ord.	£1	50/-		15	15	6 0 0	62/6	50/-
Assoc. Elec. Ord.	£1	66/3		15	15	4 10 6	67/-	53/9
Automatic Tel. & El.	£1	78/9		17	17‡	4 6 3	82/6	71/3
Babcock & Wilcox	£1	46/3	−6/3	13‡	13	5 12 3	52/6	45/-
Bakelite	10/-	40/-	+6/3	15	15	3 15 0	40/-	22/-
Baldwin, H. J.	2/-	2/-	−3d	20	—	—	3/-	2/-
Berry's Electric	5/-	28/9		10	20‡	3 9 6	29/-	7/3
Bowthorpe Holdings	2/-	10/9		25	27	3 0 6*	10/9	8/-
British Elec. Traction: Def. Ord. "A"	5/-	47/-	+1/-	25	35	3 14 6	47/-	35/6
B.I. Callender's	£1	56/3	−9d	12½	13½	4 12 3	58/6	44/9
B.I. Callender's 6% Pref.	£1	20/6		6	6	5 17 0	20/6	19/9
British Thermostat	5/-	23/9		30	35	3 13 9*	28/-	18/6
British Vac. Cleaner	5/-	8/3		10	7½*	4 11 0	8/3	4/6
Brook Motors	10/-	58/9	+2/6	25	24½*	4 2 0	58/9	46/-
Bulgin, A. F.	1/-	11/6		45	50	4 7 0	11/6	6/9
Bulpitts	5/-	18/9		—	15	4 0 0	18/9	10/-
Burco Dean	5/-	18/3	+1/-	22½	16*	4 7 9	18/3	12/3
Cable & Wireless: Ord.	5/-	18/3	+3d	10	10*	2 14 9	18/3	12/3
4% Loan	100	94½		4	4	4 4 9	95	93
Chloride El. Storage "A"	£1	70/-	+3/-	17½	20‡	3 16 0*	70/-	43/8
Clarke Chapman	£1	57/6e		27½	13‡*	4 15 9	66/3	52/6
Cole, E. K.	5/-	24/6	+6d	17½	20	4 1 9	24/6	17/3
Contactor Switchgear	5/-	16/9	+9d	14	14	4 3 6	16/9	12/-
Cossor, A. C.	5/-	7/6		Nil	5	3 6 9	9/-	6/3
Crabtree	10/-	34/-		20	20	5 17 9	34/-	28/-
Crompton Parkinson	5/-	17/3	+3d	16	12*	3 9 6	17/3	11/9
Davis & Timmins	5/-	19/-		18	20	5 5 3	19/-	14/6
De La Rue	10/-	60/-	+3/9	17½	20	3 6 9	60/-	30/3
Decca "A"	10/-	44/-	+1/6	43‡	50	4 11 0*	44/-	33/3
Desoutter	5/-	30/-		32½	21‡*	3 12 3	30/-	19/-
Dewhurst	2/-	8/9		20	20	4 11 6	8/9	7/3
Dictograph Tel.	2/-	9/-	+3d	20	20	4 9 0	9/-	7/-
Dubilier Condenser	1/-	5/-	+3d	20	25	5 0 0	5/-	3/3
Duport	5/-	16/6	+6d	25	12½*	3 15 9	16/6	10/3
E.M.I.	10/-	58/-		15	20*	3 9 0	64/6	48/-
Electrical Apparatus	5/-	15/9	−9d	14½	14½	4 12 0	16/6	13/-
Electrical Components	5/-	11/9x.c.		12½	15	4 5 0*	11/9	7/-
Elec. Construction	£1	36/6	+6d	8½	9	4 18 9	36/6	27/9
Elliott-Automation	5/-	27/6	+1/6	—	10‡	1 16 3	30/6	16/9
English Electric	£1	48/3		14	14	3 17 6*	48/9	37/10
English Electric 3½% Pref.	£1	13/-		3½	3½	5 15 6	12/9	12/3
Ericsson Tel.	5/-	24/-	−1/-	12†	13†	4 8 6	27/3	22/3
Ever Ready	5/-	27/6		20	27½‡	3 0 0*	28/-	13/3
Falk Stadelmann	£1	30/-	+4/-	17½	10*‡	6 13 3	32/9	25/-

The above quotations are based upon middle prices in the Stock Exchange Daily Official List.
* After scrip issue. † Free of income tax. ‡ Dividend indicated.

shares of Simms Motor & Electronics. The firm has been known under that name since the acquisition of the former Motor & Electronics Corporation (now M.E.C. Holdings) two years ago, in accordance with the management's policy of diversifying the interests. Last year's profits were affected by a recession in demand for heavy vehicle equipment, but the dividend was maintained in effect at 12½ per cent and the report issued in July gave a good account of progress in the period now running: in comparison with the previous year's figures, turnover, new orders and profits were all said to have increased. Quoted at 14s 3d, with an interim dividend declaration due, the shares show a yield of just on 4½ per cent.

Electrical Investments

Company or Board	Nom. Value	Middle price 26th Oct.	Week's Rise or Fall	Dividend Previous	Dividend Last	Yield % £ s d	1959 Highest	1959 Lowest
Electrical Shares—continued								
G.E.C.	£1	45/6	−2/6	10	10	4 8 0	48/-	31/3
G.E.C. 6½% Pref.	£1	22/-		6½	6½	5 18 3	22/-	20/3
General Cables	5/-	7/9		24	15	9 13 6	9/3	7/6
Greenwood & Batley	£1	108/-		20	30	5 11 0	108/-	75/-
Hackbridge Holdings	5/-	18/9	−6d	20	20	5 6 9	19/3	14/3
Hackbridge & Hewittic	5/-	15/-		20	20	5 0 0*	15/-	10/6
Head Wrightson	5/-	36/6	−6d	17½	20*	2 14 9	38/-	24/3
Heatrae	2/-	10/-		20	20	4 0 0	10/-	7/6
Holophane	5/-	18/9	+6d	22½	26	7 2 6	18/9	14/9
Hoover	5/-	94/-	+5/3	50	60	3 3 9	94/-	55/-
I.C.I.	£1	54/6		12	8*	2 18 9	54/6	33/-
Intl. Combustion	5/-	38/3		25	30‡	3 18 6	38/6	29/9
Intl. Computers & T.	£1	72/-	+9d	—	8‡	2 4 6	78/9	57/6
Johnson & Phillips	£1	21/9	+3d	5	5	4 12 0	30/6	20/-
Lancashire Dynamo	£1	47/6	+1/3	11	12½‡	3 19 0*	47/6	31/6
Laurence Scott	5/-	18/3	+3d	15	15	3 11 0*	18/3	14/-
Lister, R. A.	£1	48/9	+1/3	10	12½	5 2 6	48/9	32/9
Lucas, J.	£1	66/3	+5/-	7½	10‡	3 0 3	67/6	43/3
Marconi Marine	£1	42/-		10	10	4 15 3	48/6	40/-
Marryat & Scott	2/-	11/-		37½	22½*	4 1 9	11/-	8/6
Mather & Platt	£1	50/-		15	10‡*	4 5 6	51/6	41/3
Metal Industries	£1	62/6	+1/-	14	14	4 9 6	62/6	39/9
Midland Elec. Mfg.	£1	48/9	+1/3	12½	10*	4 2 0	48/9	41/6
Morphy-Richards	4/-	31/-	−6d	20	25	3 4 6	34/-	18/-
Murex	£1	56/6	−1/-	17½	15	5 6 3	57/6	42/-
Newman Ind.	2/-	3/3		10	10	6 3 0	3/6	2/3
Oldham & Son	1/-	3/-		17½	17½	5 16 9	3/3	2/6
Parsons, C. A.	£1	52/6	−2/6	7½	8½‡	3 1 9	58/-	45/9
Philips' Lamps	Fl.10	122/6		14	14	2 3 0	130/-	88/-
Plessey	10/-	41/6	−3/-	30	14*‡	3 7 6	44/6	23/6
Pye	5/-	19/6	+6d	12½	12½	3 4 0	19/6	13/9
Pyrotenax	5/-	44/6	+2/6	—	34	3 14 0	46/-	33/9
Reliance Clifton	5/-	24/6	+6d	15	15	3 1 3	24/6	17/6
Reyrolle	£1	92/6	−1/3	17½	17½	3 15 9	98/-	85/9
Rheostatic	4/-	11/3		12½	12½	4 8 9	11/3	8/3
Richardsons Westgarth	10/-	12/3	−6d	8½	8½	6 16 0	15/3	11/6
Simon-Carves	5/-	31/3		25	25	4 0 0	32/-	28/6
Smith (England), S.	4/-	21/-	+1/9	20	12½*‡	2 7 6	21/-	11/6
Southern Areas	£1	14/3	+3d	Nil	Nil	Nil	15/-	10/6
Strand Elec.	5/-	16/6	+4/3	15	20	6 1 3	16/6	8/6
Sturtevant	5/-	23/-	+3/-	15†	15†	5 6 6	23/-	17/-
Sun Elec.	5/-	16/3	+6d	25	25	3 17 0*	16/9	8/3
Switchgear & Cowans	5/-	15/-	+1/3	22½	15*	5 0 0	15/6	10/3
T.C.C.	10/-	52/6		25	25	4 15 3	52/6	38/-
Telephone Mfg.	5/-	7/-		10	10	7 2 9	7/3	4/9
Telephone Rentals	5/-	18/-		12½	12½*	3 9 6	18/-	11/9
Thompson (John)	5/-	21/3	+1/3	25	25	5 17 9	25/6	20/-
Thorn Elec.	5/-	45/6	+3/6	17½	20	2 4 0	46/-	26/3
Thornycroft	£1	26/3	+1/3	12½	7½	5 14 3	30/-	20/6
Tube Investments	£1	108/9	+2/6	15	17½	3 4 3	110/-	71/6
Vactric	5/-	44/-		25	37½	4 3 3	46/6	26/3
Veritys	5/-	1/6		12½	2½	—	5/-	1/3
Walsall Conduits	4/-	14/-	+3d	22½	22½	3 13 3*	14/2	10/8
Ward & Goldstone	5/-	56/-	+7/-	25	30	2 13 6	56/-	30/6
Watford	2/-	14/9	+1/9	25	25*	3 7 9	14/9	7/6
Westinghouse	£1	52/6	−1/3	10	10	3 16 3	53/9	39/6
West, Allen	5/-	13/9		12½	11§*	4 5 0	13/9	11/9
Wolf Electric	5/-	9/9	+6d	10	10	5 2 6	9/9	7/9

Mixed Changes

Among the leaders in the electrical equipment market, A.E.I. and English Electric remained steady, but G.E.C. at 45s 6d, Parsons at 52s 6d and Reyrolle at 92s 6d gave up part of previous advances. Babcock & Wilcox at 46s 3d showed a loss of as much as 6s 3d over the week, but there were few other changes of much consequence among heavy engineering shares; John Thompson recovered 1s 3d to 21s 3d. In the field of domestic equipment, Hoover put on yet a further 5s to 94s and remained there after news of the company's substantial price reductions. Falk, Stadelmann were marked up 4s to 30s. Pye at 19s 6d, Decca "A" at 44s and Thorn Electrical at 45s 6d were among the best supported radio shares. Plessey shed 3s of the previous week's 7s advance and B.I.C.C. eased to 56s 3d on reports of persistently difficult trading conditions in the cable industry. Pyrotenax rose from 42s to 46s and later reacted to 44s 6d.

Good Features

Ward & Goldstone were the subject of favourable comment and rose very sharply from 49s to 56s during the week; the yield on the last dividend contracted to less than 3 per cent. Chloride Electrical Storage remained strongly on the upgrade, reaching 70s, and Brook Motors again advanced by more than 2s, to 58s 9d. Electrical Components were quoted ex two distributions, one of them a free 50 per cent scrip issue and the other a cash offer of new shares, by way of rights, at 7s 6d. In the new form the 5s shares moved up to 11s 9d. Gains of one to two shillings were marked in Lancashire Dynamo, Switchgear & Cowans, Watford and Allied Insulators.

Strand Electric Prospects

There has been a substantial rise in the 5s shares of Strand Electric Holdings, to about 16s 6d, since the appearance of the annual report, in which the chairman described prospects for future years as excellent. During the year ended last April, there was an improvement in turnover and trading profits. The net surplus after tax and expenses was little changed but the directors decided that circumstances justified a more liberal distribution and raised the dividend rate from 15 to 20 per cent. On that basis the yield from the shares works out at a fraction over 6 per cent. A scrip issue is to be considered when conditions seem appropriate. In his review, the chairman put stress upon the strengthening of the company's competitive position as a result of considerable work and expenditure upon improving designs and efficiency.

REPORTS and DIVIDENDS

Babcock & Wilcox, Ltd., are paying an interim dividend of 4½ per cent (against 6 per cent). In announcing the reduced dividend, the directors state that the design and manufacture of nuclear and large boiler plant have necessitated a considerably greater amount of development work than anticipated and the new processes involved have adversely affected and delayed production. In these circumstances the board has felt it necessary to reduce the interim dividend. In spite of severe competition, orders received in recent months have been encouraging in volume, although at reduced profit margins.

Contactor Switchgear, Ltd., reports that after providing £67,364 for taxation, the profit for the year ended 31st July last is £78,901, as compared with £84,463 for the preceding year. General reserve receives £60,000 and it is proposed to pay a final dividend of 10 per cent, maintaining the distribution for the year at 14 per cent. The balance carried forward is £13,834 (against £13,057 brought in).

The Ever Ready Trust Co., Ltd., is paying an interim dividend of 7 per cent (against 6 per cent). It is stated that the increase is to make the interim and final dividends more equal and it carries no indication of a larger total.

The Ever Ready Co. (Great Britain), Ltd., has announced an interim dividend of 5 per cent (against the equivalent of 3 per cent after allowing for a scrip issue). The increase is to reduce the margin between the interim and final dividends and does not indicate an increased total distribution.

Edwards High Vacuum, Ltd., in announcing an increase in the interim dividend from 4 per cent to 6 per cent, states that the increase is to enable the interim and final dividends to be more closely related, and does not indicate an increased total payment for the year.

Reliance-Clifton Cables & Industrial Products, Ltd., has declared an interim dividend on the ordinary and "A" non-voting ordinary stock of 6 per cent (unchanged).

Cable & Wireless (Holding), Ltd., has declared a dividend of 2½ per cent (unchanged) for the third quarter of the year.

T. Clarke & Co., Ltd., are paying an interim dividend of 8 per cent (against the equivalent of 6 per cent after allowing for a scrip issue).

The Greengate & Irwell Rubber Co., Ltd., has declared an interim dividend of 5 per cent, the same as last year.

Increases of Capital

Wilkins & Mitchell, Ltd.—Increased by £660,000, in 5s ordinary shares, beyond the registered capital of £1,000,000.

Venner, Ltd.—Increased by £134,000 in 5s unclassified shares, beyond the registered capital of £246,000.

Stonebridge Electrical Co., Ltd.—Increased by £40,000 in £1 ordinary shares, beyond the registered capital of £10,000.

New Companies

Swindon Condenser Co., Ltd.—Registered 28th September. Capital £100. Manufacturing and dealing in or with miniature and sub-miniature electrolytic capacitors and electronic components, etc. Directors: H. G. Empson, C. B. Levitt, N. A. Levitt, J. W. Binsted, R. V. Hipperson and C. E. P. Scanes. Regd. office: Industrial Estate, Cheney Manor, Swindon, Wilts.

Morris & Co. (Southend-on-Sea), Ltd.—Registered 24th September. Capital £1,000. Manufacturers and distributors of, agents for, and wholesale and retail dealers in electrical goods of all kinds, radio and television receivers, etc. Directors: G. W. Rogers and N. H. G. Morris. Regd. office: 17, Clarence Road, Southend-on-Sea.

Williams (Kidderminster), Ltd.—Registered 28th September. Capital £1,000. Electrical equipment specialists, etc. Directors: J. T. Williams, Mrs. Edna Williams, J. S. M. Williams and G. Green. Regd. office: 57, Blackwell Street, Kidderminster.

Helimatic, Ltd.—Registered 17th September. Capital £10,000. Electrical engineers, refrigeration engineers, etc. Solicitors: Reynolds Gorst & Porter, 7, Arundel Street, W.C.2.

J. Wilson & Son (Colne), Ltd.—Registered 17th September. Capital £10,000. Manufacturers and repairers of and dealers in dynamos, motors, armatures, magnetos, and batteries. Directors: J. Wilson, C. Wilson, C. Bridge and A. Chippendale. Regd. office: Queens Works, Burnley Road, Colne.

Levers (Electrical Appliances), Ltd.—Registered 18th September. Capital £1,000. Dealers in and manufacturers of domestic and industrial electrical appliances of all kinds, radio and television engineers, etc. Directors: S. Lever and Mrs. Alma Morris. Regd. office: Transport Building, Islington, Liverpool, 3.

M. H. Sutton (Electrical), Ltd.—Registered 18th September. Capital £1,000. Manufacturers and distributors of, agents for, and wholesale and retail dealers in and hirers and repairers of electrical goods, radio and television receivers, etc. Regd. office: 2, Serjeant's Inn, E.C.4.

North Eastern Enterprises, Ltd.—Registered 17th September. Capital £1,000. Manufacturers of and dealers in electrical apparatus, appliances and fittings, etc. Directors: P. Radford and W. Potts. Regd. office: 90, Grey Street, Newcastle-on-Tyne.

M. Hyams (Electrical Contractors), Ltd.—Registered 16th September. Capital £100. Electrical engineers and contractors, etc. Directors: M. Hyams, S. P. Hyams and B. M. Collins. Regd. office: 20/21, Lawrence Lane, Cheapside, E.C.2.

Bourne End Electrical Supplies, Ltd.—Registered 21st September. Capital £100. Distributors of, agents for, and wholesale and retail dealers in electrical goods of all kinds, radio and television sets, etc. Directors: E. W. Bunce, senior, E. W. Bunce, junior, and J. D. Bowler. Regd. office: 31, St. James's Place, S.W.1.

K. G. Jackson, Ltd.—Registered 22nd September. Capital £100. To acquire the business of electrical contractors carried on by K. G. Jackson, etc. Directors: K. G. Jackson and D. Jackson. Regd. office: 129, Canterbury Road, Davyhulme, Manchester.

S.E. Laboratories (Research & Development), Ltd.—Registered 5th October. Capital £100. Research and development in connection with the manufacture of electrical and mechanical apparatus, electronic machinery and scientific instruments, etc. Directors: R. Schild and P. C. Epstein. Regd. office: Factory 606, North Feltham Trading Estate, Feltham, Middx.

Meric Domestic Appliances, Ltd.—Registered 29th September. Capital £100. Manufacturers and distributors of and agents for and wholesale and retail dealers in electrical goods of all kinds, radio and television receivers, etc. Directors: K. L. Reeves and M. J. Meade. Regd. office: 152, Plumstead Road, S.E.18.

Key Electrical Co., Ltd.—Registered 1st October. Capital £100. Electricians, radio and electrical engineers, etc. Directors: C. W. Key and D. J. Hankin. Solicitors: Wallington, Fabian & White, Watford.

Electri-Caddies, Ltd. — Registered 1st October. Capital £100. Manufacturers of and dealers in electrically propelled vehicles, etc. Regd. office: 34, South Molton Street, W.1.

Minifix of Poole, Ltd.—Registered 6th October. Capital £100. Manufacturers of and dealers in electrical apparatus, etc. Regd. office: 46, High Street, Poole, Dorset.

Cranfield Electrical, Ltd.—Registered 6th October. Capital £1,000. Electrical cable stripping contractors, electrical appliance assembly contractors, etc. Directors: C. A. J. Billington and G. H. Gentle. Regd. office: Mill Road, Cranfield, Beds.

S. Hodgson & Co. (Halifax), Ltd.—Registered 2nd October. Capital £100. To acquire part of the undertaking and to carry on the business of S. Hodgson & Co. (Halifax), Ltd. (incorporated 1928); to carry on the business of manufacturers, sellers and agents of motors, dynamos, etc. Directors: S. Hodgson, P. Sutcliffe, Miss Jessie W. Hodgson, G. A. Clare and E. H. Stafford. Regd. office: High Level Works, Pellon, Halifax.

Wallisdown Electrical Appliances, Ltd.—Registered 2nd October. Capital £1,000. Manufacturers of and dealers in electrical and mechanical machines, articles, parts and components, etc. Solicitors: Reynolds, Gorst & Porter, 7, Arundel Street, W.C.2.

E. W. Dakins, Ltd.—Registered 7th October. Capital £100. Electrical, radio, television and refrigeration engineers, etc. Directors: E. W. Dakins and Ann L. Dakins. Regd. office: 25, London Road, Southend.

King Electromat Co., Ltd.—Registered 8th October. Capital £500. Electrical equipment specialists, etc. Directors: C. A. King, Edith King and A. W. Shelton. Regd. office: Alice Square, Old Basford, Nottingham.

J. Hammond & Co., Ltd.—Registered 8th October. Capital £2,500. Electrical engineers and contractors, etc. Directors: C. I. R. Haynes, Mrs. Barbara J. Haynes and A. F. L. Lafbery. Regd. office: 50, Lambrook Terrace, Fulham, S.W.6.

Surtronics, Ltd.—Registered 6th October. Capital £1,000. Manufacturers of and dealers in dynamos, motors, armatures, electrical plant, etc. N. R. Jolly is the first director. Regd. office: 50, Lincoln's Inn Fields, W.C.2.

Dubai State Telephone Co., Ltd.—Public company. Registered 14th October. Capital £64,995. Telephone, telegraph and electric light, heat and power supply company. Directors: His Highness Shaikh Rashid Bin Said, Ruler of Dubai State, Ali Haji B. A. Alowais, Ali Haji A. Swazi, Sir Victor H. Tait, G. R. Scott-Farnie and H. A. Adams. Solicitors: T. P. Kenneth Kemble, 40, Park Street, W.1.

L. Bird (Winchester), Ltd.—Registered 14th October. Capital £2,000. Manufacturers of and dealers in artificial lighting, apparatus, electrical plant, etc. Directors: A. A. L. Bird, L. L. H. Leftley and B. J. H. Vear. Regd. office: 20/20a, Jewry Street, Winchester.

F. A. Smith (All Electrical), Ltd.—Registered 14th October. Capital £5,000. To acquire the business of F. A. Smith & Son at Grimsby, and to carry on the business of electrical, radio, television engineers, etc. Directors: K. A. Smith and Mrs. Gladys Smith. Regd. office: 92-94, Farebrother Street, Grimsby.

R. A. New, Ltd.—Registered 15th September. Capital £100. Electricians, radio

and television engineers, etc. Directors: R. A. New and Doris L. New. Regd. office: 200, St. Ann's Road, N.15.

Mantle & Butterworth, Ltd.—Registered 15th September. Capital £6,000. Electrical engineers, etc. Directors: J. Mantle and R. Butterworth. Regd. office: 53, Bury Road, Rawtenstall.

Dynamics (Bristol), Ltd.—Registered 15th September. Capital £5,000. Manufacturers of and dealers in washing machines, refrigerators, television and radio receivers and transmitters, etc. Directors: F. H. Woolway, I. J. D. Ralls and R. A. Earle. Regd. office: 20, Cumberland Street, Bristol, 2.

Harrisons Refrigeration & Electrical Rentals, Ltd.—Registered 16th September. Capital £100. Renters of and wholesale and retail dealers in and agents for manufacturers of domestic, household and general electrical and other equipment and appliances, etc. Directors: P. D. H. Maidment and F. Harrison. Regd. office: 5, St. John Street, E.C.1.

Wm. E. Little, Ltd.—Registered 16th September. Capital £1,000. Electrical and mechanical engineers and contractors, etc., and to acquire the business of W. E. L. Little, now carried on at 53, Eleanor Road, Stratford, E.15, as W. E. Little. Directors: W. E. Little and Selina M. Little. Regd. office: 53, Eleanor Road, Stratford, E.15.

Distron Engineering Co., Ltd.—Registered 15th September. Capital £500. Electrical engineers and contractors, etc. Regd. office: 39/41, New Broad Street, E.C.2.

Kenneth A. Smith, Ltd.—Registered 16th September. Capital £5,000. To acquire the business carried on as Kenneth A. Smith at Grimsby, and to carry on the business of electrical, radio, television and mechanical engineers, merchants and contractors, etc. Directors: K. A. Smith and Mrs. Gladys Smith. Regd. office: 170, Cromwell Road, Grimsby.

Harleys (Torquay), Ltd.—Registered 5th August. Capital £2,000. To acquire the business of radio, television and electrical equipment dealers and engineers carried on at Torquay as "Harleys," etc. Directors: P. J. George and P. Martin. Regd. office: 215, Union Street, Torquay.

James S. Graham & Co., Ltd.—Registered 3rd September. Capital £2,000. To acquire the business of an electrical and electronic engineer and contractor now carried on by J. S. Graham at 64, King Charles Road, Surbiton, as James S. Graham & Co. Directors: J. S. Graham and Mrs. Moragh D. Graham. Regd. office: 64, King Charles Road, Surbiton, Surrey.

T. F. Lawson (Wholesale), Ltd.—Registered 3rd September. Capital £100. To acquire the business of electrical wholesale distributors carried on by T. F. Lawson at Blackburn, etc. The first director is T. Lawson. Regd. office: 76, Victoria Street, Blackburn.

Reco Electronics (Sales), Ltd.—Registered 7th August. Capital £100. Manufacturers of and dealers in electrical goods, etc. Directors: E. Adler and R. Murtagh. Regd. office: 32a, Booth Street, Manchester, 2.

J.K. Contractors, Ltd.—Registered 12th August. Capital £1,000. Electrical engineers and contractors, etc. Regd. office: 45-46, Crawford Street, W.1.

Valcon Electrical, Ltd.—Registered 1st October. Capital £100. Directors: J. R. Valentine and J. L. Concannon. Regd. office: 152, Plumstead Road, S.E.18.

Joseph E. Brookes (Electrical Appliances), Ltd.—Registered 24th September. Capital £1,000. Electricians, electrical contractors, and engineers, dealers in, and installers of electrical and mechanical apparatus and goods, television and radio engineers. Directors: J. E. Brookes and Mrs. Caroline M. Brookes. Regd. office: 29, Glebe Street, Stoke-on-Trent.

Beacon Auto Electrics, Ltd.—Registered 7th September. Capital £1,000. Electrical engineers and electrical installation contractors, and electrical plant maintenance engineers, etc. Directors: G. D. Chapman, H. W. Collier, Mrs. Vera Chapman and Mrs. Joan L. Collier. Regd. office: 20a, Barton Road, Patricroft, Eccles, Nr. Manchester.

Better Housekeeping Appliances (Southampton), Ltd.—Registered 24th September. Capital £100. Electricians, mechanical engineers, manufacturers of and dealers in electrical apparatus and goods, etc. Directors: W. Wallis and Mrs. Ethel Wallis. Regd. office: 3, St. Mary's Road, Southampton.

V. & D. Keale (Contractors), Ltd.—Registered 23rd September. Capital £2,000. Electrical engineers and contractors, etc. Directors: E. M. Keale and F. A. Parker. Regd. office: 156, High Street, Staines.

E. V. Peploe, Ltd.—Registered 23rd September. Capital £300. Electrical engineers and contractors, etc. Directors: E. A. Peploe and Mrs. Vera W. Peploe. Regd. office: 39a, Woodgrange Road, E.7.

Thaine Electrical Appliances, Ltd.—Registered 22nd September. Capital £100. Manufacturers of, and dealers in artificial lighting apparatus, etc. Directors: S. G. Thaine and Mrs. Irene F. Thaine. Regd. office: 29, Duke Street, Henley-on-Thames.

Bankruptcies

M. S. Pollard, lately carrying on business at 21, Preston Road, Brighton, electrical dealer. —Public examination 11th December at the Court House, Church Street, Brighton.

M. J. Haine and **M. E. Simpson,** trading as Haine & Co., 77, Westbourne Grove, London, W.2, electricians. (Separate estate of M. J. Haine.).—Last day for receiving proofs for dividend 2nd November. Trustee, Mr. A. A. Walter, Bankruptcy Buildings, Carey Street, London, W.C.2, Official Receiver.

E. V. Williams, 5, Clevedon Passage, Stoke Newington, London, N.16, electrician.—Last day for receiving proofs for dividend 2nd November. Trustee, Mr. G. F. Morris, Bankruptcy Buildings, Carey Street, London, W.C.2, Senior Official Receiver.

J. E. Byrne, 3, Wells Yard, Waterworks Street, Hull, electrical contractor.—Application for discharge to be heard on 11th November at the Guildhall, Hull.

D. W. Meager, trading as Telelectrix (Enfield), 16, Bellamy Road, Cheshunt, Herts., and lately residing at 12, Sterling Avenue, Waltham Cross, and carrying on business at 97, Lancaster Road, Enfield, Middx., as a radio and electrical dealer. —Receiving order made 6th October on a creditor's petition. Public examination 21st December at the Court House, Fore Street, Upper Edmonton, London, N.18.

E. Baker, lately carrying on business at 157, Lightbowne Road, Moston, Manchester, under the style of Star Radio and Electric Service, as an electrical contractor.—Public examination 11th December at the Court House, Quay Street, Manchester.

J. E. Woodcock, lately carrying on business at 85, Pershore Road South, King's Norton, Birmingham, under the style of Industrial Maintenance and Power Service, electrical contractor.—Last day for receiving proofs for dividend 4th November. Trustee, Mr. W. H. Haigh, Official Receiver, Somerset House, 37, Temple Street, Birmingham, 2.

TRADE MARK APPLICATIONS

APPLICATIONS have been made for the registration of the following trade marks. Objections may be entered up to 14th November:—

BICC (design). No. 786,638. Class 6. Wires, strands, strips, braids, sheets, tapes, rods, tubes and shaped sections, none being for electrical purposes; non-insulated cleats, racks and suspenders, and parts; all for use in connection with electric cables and wires; masts, poles, towers, etc. **BICC** (design). No. 786,640. Class 9. Cables, insulated wires, cable installations, wiring systems and overhead conductor installations; current collecting devices for use with electric conductors in electric cranes, travelling gantries, hoists, etc.; capacitors, meters, resistances, fuses, connections, apparatus for locating faults in electric cables and wires, waveguides and parts; fuse wire, electrodes for electric welding apparatus; strands, strips, tapes, rods, sheets, tubes, etc.; and radio and television aerials and aerial masts and towers, etc.—British Insulated Callender's Cables, Ltd., Norfolk House, Norfolk Street, London, W.C.2.

Vapodyne. No. 783,952. Class 7. Boilers, pressure regulators and steam condensers, all being parts of machines or of installations used for the cooling of electronic tubes, nuclear reactors and of electrical apparatus and instruments operated by means of semiconducting devices and used as stills (other than for experimental purposes) for distilling water, and used for space heating purposes.—Compagnie Française Thomson-Houston, Paris. Address for service, c/o Baron & Warren, 16, Kensington Square, London, W.8.

Electromatic (design). No. 787,791. Class 7. Washing machines and parts.—Continental Washing Machine Co., Ltd., 63, Great Eastern Street, London, E.C.2.

SC (design). No. B757,154. Class 9. Electric vacuum cleaning apparatus and domestic electric coffee grinding machines, and parts.—Scintilla, Ltd., Soleure, Switzerland. Address for service, c/o Marks & Clerk, 57-58, Lincoln's Inn Fields, London, W.C.2.

Ceramite. No. B776,664. Class 9. Electric resistances having a ceramic base.—Zenith Electric Co., Ltd., Zenith Works, Villiers Road, Willesden Green, London, N.W.2.

Thorn Plasteck. No. 766,314. Class 9. Dials bearing information and being for use with scientific instruments, panels bearing information and being for mounting instruments and instrument controls, and parts, all made wholly or principally of plastics.—Thorn Electrical Industries, Ltd., 105-109, Judd Street, London, W.C.1.

Ringway. No. B784,599. Class 9. Electric switches and electric plugs.—Wandsworth Electrical Manufacturing Co., Ltd., Albert Drive, Sheerwater, Woking, Surrey.

Autofex. No. 784,685. Class 9. Electrical instruments and apparatus and parts.—Brush Electrical Engineering Co., Ltd., Falcon Works, Loughborough, Leics.

I.C.T.L. No. B787,811. Class 9. Scientific apparatus; electric and electronic apparatus for use in the checking (supervision) and remote control of industrial machinery and apparatus and in the calculation and furnishing of data and statistical information, etc.—International Computers & Tabulators, Ltd., 17, Park Lane, London, W.1.

C.W.S. (design). No. 788,122. Class 9. Electrically operated cleaning apparatus and instruments; radio sets, television sets, radiogramophones, etc.—Co-operative Wholesale Society, Ltd., 1, Balloon Street, Manchester.

Challenge. No. 789,921. Class 9. Electric vacuum cleaners and parts.—Challenge Cycle & Motor Co., Ltd., Lark Hill Road, Worcester.

Octotherm. No. B788,893. Class 11. Apparatus and installations all being electrically operated for heating floors.—Hartley Electromotives, Ltd., 39, Dover Street, London, W.1.

Regal Lamps. No. 790,737. Class 11. Electric lamp bulbs.—Auto Supplies (Leeds), Ltd., 28, Nursery Lane, Leeds, 17.

Radio Hobbies Exhibition

The International Radio Hobbies Exhibition, organised by the Radio Society of Great Britain, will be held from 25th to 28th November next at the Royal Horticultural Society's Old Hall, Westminster.

NEW ELECTRICAL EQUIPMENT

High Intensity Bench Light

Miniature fluorescent tubes are used in the type A.90 local lighting unit manufactured by P. W. ALLEN & Co., 253, Liverpool Road, London, N.1. The metal reflector housing the two 12in 8 W lamps is connected to the main body by a 12in flexible tube and a swivel joint. Two models are available, each complete with an 8ft three-core flexible p.v.c. cable, tubes, choke and manual starter for 200/250 V a.c. supplies: a universal model with a 7in diameter weighted base, price £8 8s, and the fixed model with a four-hole 4in diameter flanged base, price £8. The light is finished in silver grey hammer stove enamel with bright chrome tubing.

Allen type A.90 bench light

Hot Air Steriliser

Uniform heating to within ±2°C throughout the 3 cu ft chamber of the "Buckingham" hot air steriliser introduced by SURGICAL EQUIPMENT SUPPLIES, LTD., Westfields Road, North Acton, London, W.3, is obtained by drawing air over black heating elements in an outer heating chamber and into the sterilising chamber by a 7in diameter seven-bladed circulating fan. Eight tray elements totalling 2,400 W are used to heat the steriliser to between 100 and 250°C.

A combined double pole main switch and time clock—0 to 360 min—controls the fan and heater elements, and a thermostatic switch graduated to 300°C controls the temperature which is registered on a dial thermometer reading 110 to 250°C. An indicator lamp in circuit with the timer main switch is extinguished at the end of the pre-set sterilisation period. A safety cut-out pre-set at 250°C is incorporated.

Moulded Case Circuit-Breakers

At an exhibition in London on 6th and 7th October a range of moulded case circuit-breakers was introduced by E.C.C. MOULDED BREAKERS, LTD., Fordhouse Road Works, Wolverhampton. The range comprises the NEF and NJ type breakers and the "Stab-lok" series of distribution boards in which circuit-breaker units are pressed into place in flush or surface mounting boards. These are made with from 4 to 36 ways with s.p. and n. units rated at 5 to 60 A, and from 4 to 12 ways with 5 to 60 A t.p. and n. units. The breakers have silver tungsten contacts and spring accelerated quick-make and quick-break action.

The NEF range of circuit-breakers is available in single, double or triple pole versions and covers the range of 15 to 100 A at 440 V a.c. or 250 V d.c.

Type NJ triple pole moulded case circuit-breaker

The contacts are of silver alloy and a thermal magnetic tripping unit is incorporated. Breakers in the NJ range are of the triple pole type and are available rated at from 70 to 400 A at 600 V a.c. These units have been tested at 10,000 A 600 V a.c.

A number of "Stab-lok" distribution boards were displayed, with examples of moulded case breakers incorporated in control switchgear, including a contactor type starter having a circuit-breaker unit as an interlocked isolating switch, a control panel for an 80 kW alternator incorporating a main circuit-breaker unit, and a l.v. distribution board for a technical college classroom block having main distribution breakers and sub-circuit units of the "Stab-lok" type.

Miniature Indicators

The miniature neon indicator units in the 80A-82A series recently introduced by "DIAMOND H" SWITCHES, LTD., Gunnersbury Avenue, London, W.4, are now available with round chromium plated metal trims of $\frac{11}{16}$in and $\frac{3}{4}$in diameter. These units are fitted with current limiting resistors, are suitable for operation from 115, 250 or 415 V supplies and are equipped with standard 8in leads.

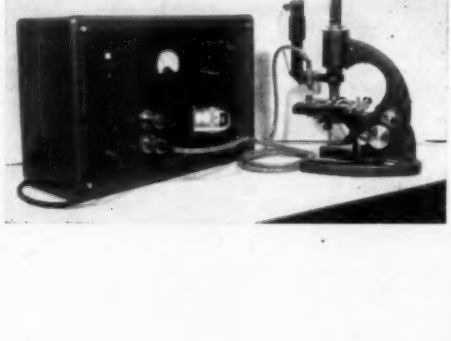
"Diamond H" miniature indicator

Electronic Micrometer

An electronic micrometer introduced by the WAYNE KERR LABORATORIES, LTD., Roebuck Road, Chessington, Surrey, measures distances in the range of 0 to 45,000 micro-inches. The minimum practical separation is 100 micro-inches and the accuracy is 1 per cent over the full range.

Measurement of the distance moved by a microscope is made by an a.c. bridge operating in conjunction with a non-contacting probe attached to and moving with the microscope tube. The power source is a 10 kc/s oscillator and the secondary of a bridge transformer is connected to a high

Left: Surgical Equipment Supplies steriliser



Right: Wayne Kerr electronic micrometer

gain amplifier followed by a phase-sensitive detector and centre zero meter. The capacitance between the probe and the test specimen is balanced against a three-terminal capacitor whose value is adjusted by a micrometer.

Operating from 105-125 or 210-250 V, 40-60 c/s mains, the instrument has a consumption of approximately 25 W. Since no physical contact with the sample to be measured is necessary, determinations of temperature coefficient, moduli of elasticity, etc., are possible on fragile samples.

Induction Heating Change-over Switch

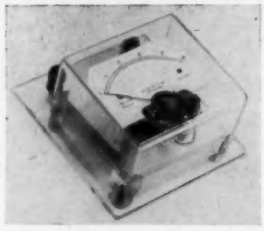
A remotely controlled change-over switch enabling the output of a single r.f. induction heater generator to be changed to an alternative work-station in a production line has been announced by DELAPENA & SON, LTD., Tewkesbury Road, Cheltenham, Glos. In addition to the r.f. power, the switch also re-directs a flow of cooling water which is used to cool the switch internally and is then passed to the

Delapena induction heater change-over switch

work coil in use by a solenoid-operated changeover valve energised automatically when the electrical circuit is made. The switch is supplied with two push-button remote control boxes connected by a 10ft flexible lead, each box having five buttons—"heat on," "heat off," "close," "open" and "master." Depressing the "close" button "makes" the contacts supplying the associated work-station, switches over the cooling water to this station and illuminates the appropriate indicator lamp on top of the switch. The "heat on" button controls the r.f. power. The "heat off" and "open" buttons control the reverse procedures and the "master" button opens the mains circuit-breaker supplying the induction heater and returns the switch to the neutral position, with both circuits open. The push-button control boxes can be replaced by cam or other mechanically operated switches if required for automatic control. The switch is capable of handling the output from a standard Delapena 15/25 kW induction heater.

Educational Pattern Instruments

The range of educational pattern instruments and accessories introduced by the WEIR ELECTRICAL INSTRUMENT CO., LTD., Bradford-on-Avon, Wiltshire, includes a 3½in indicator in a desk type stand. It is a permanent magnet, moving coil instrument having full scale deflection for 10 mA and 100 mV. Its 10 Ω internal resistance is comprised of manganin and copper proportioned to give adequate temperature compensa-



Weir demonstration pattern instrument

tion, and the scale length is 3½in. The range includes a demonstration pattern instrument housed in a transparent "Perspex" case and using repulsion type moving iron or coaxial magnet pattern moving coil systems, available in side or centre zero forms and with ranges up to 20 A or 300 V a.c. or d.c. The range is completed with resistance and shunt units, a 10 mA instrument rectifier and a ring-type current transformer.

Cable Stripper

In the cable stripper recently announced by VOLEX ELECTRICAL PRODUCTS, LTD., Salford, 6, a cutting blade is pre-set to ensure accurate cable sheath removal. The single tool accommodates three sizes of p.i.p.v.c. cable to B.S. 1557, 3/-029in twin flat, 3/-029 twin with earth and 7/-029 twin with earth. The cable is inserted into the appropriate aperture and the stripper forced along the cable to the desired length. For twin core with earth cables the process must be repeated for each conductor. The strippers, reference No. CS/901, are individually boxed in display cartons containing one dozen and have a retail price of 5s each.

Food Mixer

The basic equipment of the new "Mixaway" food mixer, a recent product of METWAY ELECTRICAL INDUSTRIES, LTD., Canning Street, Brighton, 7, consists of a 120 W motor unit, stand, turntable, two beaters and two glass bowls. It is fitted with a variable speed control with fifteen positions and the motor unit is easily detachable for use separately. The

Metway "Mixaway" food mixer

main bodywork of the appliance is in plastic, finished in cream and pastel blue. Ten extra attachments are available for the "Mixaway," including a meat mincer, dough kneader, blender, juice extractor, potato peeler, grater and slicer, coffee grinder, etc., as well as a drill set, lambswool buffer and polishing brush. The price of the machine is £19 11s 6d plus £3 10s 8d purchase tax.

Tumbler Dryer

A new tumbler clothes dryer, the Parnall "Auto-Dry De Luxe," model TD.59, is announced by the Electrical Division of RADIATION, LTD., 255, North Circular Road, London, N.W.10. This model is additional to the company's "Auto-Dry" standard model and differs in several material respects. Although occupying no more floor space, covering only 20½ sq in, it is 33½in high compared with 29in for the standard model. Styling has been improved by the provision of a control panel at the front of the machine leaving the top free as an extra working surface. The door is circular instead of rectangular and changes have been made to the heating system and layout. The capacity is 6 lb dry weight of clothes and a choice of two colours is offered. The white machine has a grey control panel with chromium trim and yellow relief, while the cream machine has a grey control panel with chromium trim and red relief. The price is £41 13s 8d plus £7 16s 4d purchase tax.

Parnall "Auto-Dry De Luxe" tumbler dryer

Refrigeration Congress

WORK OF SCIENTIFIC AND TECHNICAL COMMISSIONS

AT the tenth congress of the International Institute of Refrigeration held recently in Copenhagen the work of the Institute's nine scientific and technical commissions since the last congress in 1955 was discussed and a number of papers were presented.

The subjects dealt with by the various commissions included the detection of impurities in gases, metals and other solids, using the measurement of thermal and electrical conductivity and magnetic sensitivity, in addition to electronic and nuclear resonance techniques. The properties of thermal insulating materials, the use of heat flow meters and the application of rheo-electric analogies were also discussed. One commission had prepared safety recommendations and published recommendations for an international testing code for refrigerating machines, and discussed the design, construction and operation of refrigeration machinery and air conditioning plants. Other commissions dealt with the application of refrigeration to foodstuffs and agricultural products, cold stores and ice-making plants and refrigerated transport.

Among the papers presented were those by J. B. Gardner and W. M. Nicol on the application of an electronic computer to distillation calculations for low temperature air separation plant columns, and a description of an ionic thermometer for liquid helium by I. Fasoli, F. Gaeta and F. Scaramuzzi in which the anode current in a diode having an emitting layer of polonium on one electrode is used as a temperature indicator. A magnetic method of temperature measurement between 4 and 14°K in which a measurement is made of the change in mutual inductance in a specially wound coil, resulting in the movement of a small paramagnetic specimen within the coil, was described by M. J. M. Leask and W. P. Wolf. A new thermodynamic cycle for removing heat at very low temperatures—15 to 150°K—and rejecting it at room temperature was described by W. E. Gifford and H. O. McMahon in their paper on a low temperature heat pump. The cycle, which is applicable to small loads at these low temperatures, involves the expansion and compression of helium gas in the pressure range of 50 to 300 p.s.i.

A number of papers were given on the application of low temperatures to nuclear physics, including the use of a liquid helium bubble chamber in a 16 kGauss magnetic field for high energy physics experiments. The physical properties of metals at low temperatures were dealt with by L. Berger, who discussed the electrical and thermal conductivities of nickel in a magnetic field at a temperature of 80°K. The magnetic structure of evaporative iron films investigated by an optical method was considered by L. De Greve, R. Coussement and L. Sprengers, and the current sensitivity to magnetoresistance in ferromagnetic films was discussed by A. A. Hirsch. The field dependency of the electrical resistances of thin films of iron, nickel and cobalt measured at liquid helium temperatures was covered by A. Van Itterbeek, A. Dupré and P. Cepts. The change in resistance was found to be of the order of 10 per cent between 10 and 100 μA.

Instrumentation Problems

Problems associated with instrumentation were also dealt with, I. A. Pavlova describing the use of semiconductor thermistors for measuring low temperatures, and electrical networks for simulating refrigerating plants were described by U. Wesser and E. Blass. Two instruments for the study of motor conditions in hermetically sealed compressors were dealt with by A. C. Murdoch and C. J. Hurrell. The first provided a means of measuring compressor speed by counting frequency pulses in the discharge line detected by a contact microphone and applied to a ring modulator to beat against the supply frequency. The instrument provides actual speed readings accurate to 5 r.p.m. In the second instrument the frequency of the out-of-balance in a bridge network carrying a relatively high current indicated on a meter scaled to show the proportional deviation of the motor winding resistance from that at a known temperature enabled the deviation of winding temperature to be calculated.

Cooling by the Peltier effect was discussed in a number of papers, including estimating thermo-electric cooling by A. F. Ioffe. The boundary difference between two conductors did not exceed 6°C while metals were used but semiconductors had already raised the limit to 70°C and would probably enable this to be further increased.

Heat Pumps

The use of electro-thermal heat pump installations, considered in the paper by V. S. Martinovsky and V. A. Nayer, was regarded as expedient for large capacities, but the application of electro-thermal effect was not justified practically with a temperature difference exceeding 50°C.

In a paper on the subject of nuclear refrigeration, A. Kramish discussed the possibilities of using a boiling water type reactor in driving a compressor system, or utilising the refrigerant in an absorption system as the moderator of a nuclear reactor.

Three examples of recent equipment of semi-automatic type for brine or direct expansion plants with or without liquid circulating pumps were described in the paper by G. Saint-Girons and A. Patin on electric regulating devices with semi-automatic operation for cold stores. The results of studies made of the heat pumps having an output capacity between 100 and 600 kW and utilising waste industrial water at about 28°C as the heat source were given in the paper presented by Miss M. V. Griffith and N. C. Mander. The measured costs of heating other buildings of comparable size and shape by conventional methods were used for comparison with the cost of heat pump operation.

Isotope School

AFTER eight years at Harwell, the Atomic Energy Research Establishment's Isotope School has now been established in new buildings at the Wantage Radiation Laboratory. The purpose of the school is still to give practical and theoretical instruction in the use and safe handling of radio-isotopes, but its scope has widened since its inception and is now likely to increase still further. The new premises at Wantage have been specially designed to meet its requirements. The accommodation includes a lecture room to seat 50 people, a students' room, teaching laboratory, counting rooms in which the activity of radio-isotopes can be measured, and a variety of laboratories for special purposes. The school is equipped to accept 36 students for its basic courses, but it will be possible to arrange for smaller specialised groups to be accommodated at the same time.

The 1960 programme includes five general courses and two short courses in radiological protection. As well as this, advanced lectures in chemistry and radio-biochemistry are planned and there is to be a course for medical men. Other special series are for analytical chemists and water chemists and there will be a special course in auto-radiography. If there is adequate demand, there will be a further advanced physics course and a course on the use of high activity radiation sources, as well as short orientation programmes for senior executives.

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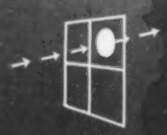

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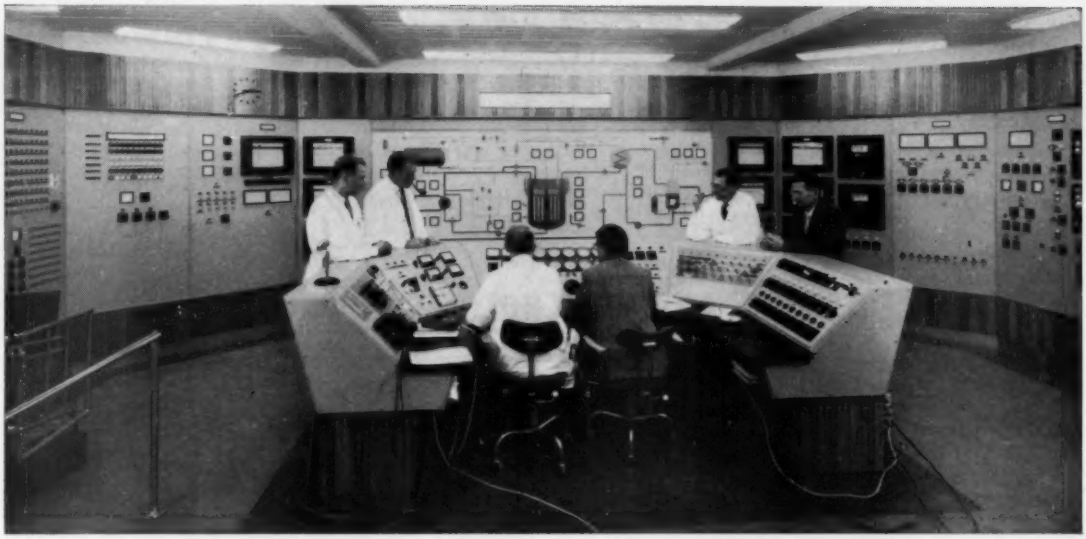


The control room of the Halden boiling heavy water reactor near Oslo

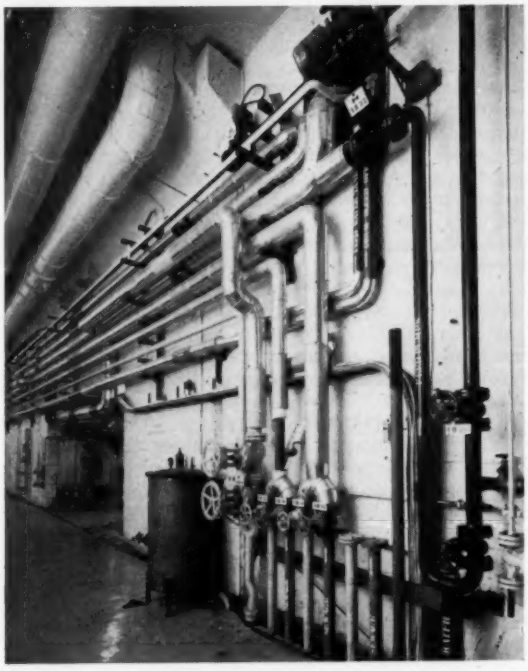
BOILING WATER REACTOR

THE Halden reactor project of the O.E.E.C. European Nuclear Energy Agency was officially opened on 10th October by H.M. King Olav. This boiling heavy water reactor has been built at Halden, south of Oslo, by the Norwegian Institutt for Atomenergi. The national agreement creating the project was signed in Oslo on 11th June, 1958, and it provides for a budget of $4 million for a three-year joint programme of experimental research. The reactor has been working at low power levels since 29th June last to enable fundamental reactor physics experiments to be performed. The power level will be gradually increased towards the ultimate design level of 20 MW heat energy.

The Halden reactor, which is the world's first heavy boiling water reactor, is designed to reach its maximum output in two stages, using different reactor cores in each stage. The fuel charge for the first core consists of seven tons of natural uranium in the form of 1in diameter cylindrical rods canned in aluminium. The fuel was manufactured by the United Kingdom Atomic Energy Authority. In addition, enriched uranium oxide spikes clad in stainless steel are used to increase the reactivity. The fuel charge is assembled in the reactor core in a hexagonal lattice. For this first fuel charge, the maximum reactor power will be approximately 5 MW with a steam temperature of 150°C and 71 p.s.i. The fuel charge for the second core will consist of 1·5 per cent enriched uranium oxide in zircalloy and this will be substituted for the first core as soon as sufficient low power experiments have been completed.

The core is contained in a mild steel pressure vessel lined with stainless steel and there is access to each individual fuel rod through openings in the top lid. Sixteen tons of heavy water act as both moderator and coolant while shrouds around the fuel rods confine the boiling to the annulus between the shroud and the fuel rod and improve the general flow pattern in the core. The steam/water mixture passes upwards inside the shroud by natural convection and leaves the shroud at the top. The heavy water steam is taken from the reactor through the lid into a header ring and a steam line connects this ring to the main heat exchanger while another line returns condensate to the reactor tank by gravity.

Part of the tunnel leading to the Halden reactor hall, with the ventilation system and tubing for the secondary circuit



On the secondary side, feed water is preheated in a moderator cooler and fed into the steam separator. The steam void distribution in the core can be influenced by using a " sub-cooler " loop. This loop takes water from the bottom of the core and, after passing through an external moderator cooler, the water may then be injected either at the bottom of the shrouds or at the top of the moderator at the periphery of the tank, or at both places.

The reactor is built in a cave blasted out of the rock and a tunnel about 60 metres long leads into the main hall. The entrance to the main hall is closed by two pressure-tight doors designed to withstand a pressure of 43 p.s.i. above atmospheric, while a water spray system will flush the walls and ceiling of the hall to quench rapidly any steam overpressure. The control room is placed in a building outside the rock, and normally no people work in the main reactor hall during the operation of the reactor.

ELECTRONIC AND PSYCHOLOGICAL PROCESSES

THE theme of Professor A. Tustin's address as chairman of the Measurement and Control Section of the Institution of Electrical Engineers was the contributions being made from electrical engineering to the work of neuro-physiologists in the study of the brain. Remarkable progress had been made in the construction of electronic models, using elements that had similar properties to nerve cells and performed some brainlike functions such as learning and recognition. These might ultimately contribute to our understanding of how brains worked. The question arose of how such mechanisms were related to psychological processes, as studied in animals and humans, in development and in maturity, in health and in disturbance, and consequently the title chosen for the address was " The Relationship of Physical Models to Psychological Processes."

The psychology of animals was often characterised by very rigid patterns of behaviour. It had been possible to account for some of such behaviour in terms of reflexes and Pavlov's concept of the conditioned reflex. But there were aspects of animal behaviour that could not be accounted for by these mechanisms alone. For example, a dog taken to a new locality by a circuitous route would sometimes take a short cut home. It had some sort of " mapping machine." Learning was more than " induction " from statistical association. It often corresponded to the acquirement of an internal co-ordinated representation of the world. In man, this representation was our " idea of reality," which was built up from sensory clues.

Our human representation of " the world about us " was extended by a sort of labile fringe, spotlighted by consciousness, where this representation could be built upon in a trial and error manner, performing the functions of prediction and problem-solving, i.e. of " thinking." It was in his motivational mechanisms, however, that man showed the greatest difference from animals. In place of stereotyped responses, overt activity might be suspended while a variety of possible activities were represented in the analogue-like representation we called " imagination." There was a play of " pattern-evaluation " that might result in decision and the attainment of long-term goals. Sensitivity to social pressures was a powerful component of motivation.

The human brain was a vast structure of minute nerve cells, which interacted by pulses along the interlacing fibres. An indispensable property of such connections was that they became sensitised in some way by use. Some remarkable devices had recently been made or proposed that made use of neurone-like elements and could simulate pattern-recognition and learning. The machine recently described by Dr. W. K. Taylor could be " taught " to identify classes of patterns by presenting examples of the patterns and pressing a button. The essentials of such a device, omitting many necessary details, were a detector of coincidence between incoming patterns and patterns of connections and a selective channel-sensitiser.

Possible models for discriminating between sounds had been considered. One due to Licklider was interesting because it included the representation of the stereophonic effect, by which differences in the sound waves at the two ears were interpreted as one sound in a particular direction. This model depended upon neurones being arranged to give responses that were, effectively, the cross-correlation and auto-correlation functions of varying signals. Dr. Cherry had independently come to the conclusion from experiments on hearing, that the mechanism must involve cross-correlation. Other models related to the possible behaviour of masses of neurones, the statistical density of excitation being regarded as the operative quantity.

It was evident that in spite of this remarkable progress some important additions to the functions performable by neurone-like elements were required, even to account only for animal behaviour. A present challenge to model makers was to construct a " map-making " device that would produce a spacially co-ordinated representation from " sensory " clues. The next stage would be an analogue of the simplest prediction and problem-solving mechanism. If such a programme was ever carried out, the " problem of consciousness " would be put in high relief. At present, it was beyond our understanding. Our " boxes of relays " could not quite cope with it, so that it was wisest to accept the fact that we did not know.

Cable Manufacturing Tests

A METHOD of testing cable insulation on a continuous basis, using radio-isotopes, has been devised by the United Kingdom Atomic Energy Authority. When manufacturing insulated wire, it is not easy to tell whether the strands of conductor metal are in the centre of the insulation or whether there are spots where the insulating skin is thin. In this new device, which has been patented, radiation from two isotope sources is split by lead blocks into two slightly divergent pairs of thin beams. These form a frame of radiation in the centre of which is the conducting wire. As long as the wire remains in the middle of the frame while the cable moves through the device, the intensity of the four beams emerging from the cable will remain the same, since they will be passing through appreciably equal thicknesses of the same material.

If, however, there is a thin spot in the covering material, i.e. if the wire core moves to one side, one or two of the beams will be affected since the metal will have a different degree of absorption of the radiation. Detectors to indicate this change in intensity can be so linked as to show on which side the thinning lies. Further information can be obtained from the Patents Exploitation Officer, U.K.A.E.A., 11, Charles II Street, London, S.W.1.

NEXT WEEK'S EVENTS

Organisers of electrical functions are advised to make use of the "Electrical Review" clearing house, Room 221, Dorset House, Stamford Street, London, S.E.1, to ascertain that proposed dates for their functions do not clash with others already arranged

MONDAY, 2nd NOVEMBER

Birmingham.—James Watt Memorial Institute, 6 p.m. I.E.E. South Midland Centre. "The Electrification of the Factories of the United Kingdom Atomic Energy Authority," by J. W. Binns and W. J. Outram.

Bolton.—Railway Hotel, Trinity Street, 7.45 p.m. A.S.E.E. Bolton Branch. "Miniature Circuit-Breakers," by J. A. Robbins.

Chester.—Grosvenor Hotel, Eastgate Street, 6.30 for 7 p.m. I.E.E. Mersey and North Wales Centre. Annual dinner.

Ilford.—Angel Hotel, 8 p.m. A.S.E.E. Essex Branch. "Wartime Evasion and Escape," by E. H. Maddox.

Leeds.—Great Northern Hotel, 7.30 p.m. A.S.E.E. Leeds Branch. "Transformers," by Mr. Stancliffe.

Liverpool.—At the Liverpool Engineering Society, The Temple, Dale Street, 6 p.m. Institute of Marine Engineers, Merseyside and North Western Section. "Nuclear Propulsion of Ships," by R. P. Kinsey.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Electronics and Communications Section. "Some Comments on the Classification of Waveguide Modes," by Dr. A. E. Karbowiak. (Supported by a contribution by L. Lewin on "Some Comments on Quasi-Optical Methods at Millimetre Wavelengths.")

Caxton Hall, S.W.1, 7 p.m. Electrical Power Engineers' Association, London Technical Group. "Special Design and Constructional Features of Bradwell Nuclear Power Station," by G. H. Inglis.

Manchester.—University Electrical Engineering Department, 7 p.m. I.E.E. North Western Graduate and Student Section. "Non-Linear Control Systems," by D. P. Atherton.

Newcastle-on-Tyne.—Rutherford College of Technology, 6.15 p.m. I.E.E. North Eastern Measurement and Electronics Group. "The New Post Office 700-Type Telephone," by F. E. Williams and F. C. Carter, and "The Design of an Automatic Sensitivity Control for a New Subscriber's Telephone Set—The British Post Office 700-Type Telephone," by F. E. Williams and F. A. Wilson.

County Hotel, Neville Street, 6.30 p.m. North East Electrical Club. "Electric Floor Heating Practice," by R. D. Jackson.

Sheffield.—Royal Victoria Hotel, 7.30 p.m. A.S.E.E. Sheffield Branch. Lecture by J. J. Moulson.

TUESDAY, 3rd NOVEMBER

Basingstoke.—Station Hotel, 7.30 p.m. A.S.E.E. Aldershot and Districts Branch. "Recent Developments in Discharge Lighting," by G. V. McNeill.

Cambridge.—Cavendish Laboratory, Free School Lane, 8 p.m. I.E.E. Cambridge Electronics and Communications Group. Section Chairman's address, "The Development of Eurovision," by M. J. L. Pulling.

Derby.—E.M.E.B. Service Centre, 6.30 p.m. Joint meeting of the I.E.E. East Midland Centre and of the Institution of Locomotive Engineers. "The Deltic Locomotive," by C. M. Cock.

Edinburgh.—Carlton Hotel, North Bridge, 7 p.m. I.E.E. South East Scotland Sub-Centre. "Silicone Electrical Insulation," by J. H. Davis.

25, Charlotte Square, 7 p.m. Institution of Plant Engineers, Edinburgh Branch. "Water Treatment in Modern High Pressure Generating Stations," by A. M. Lockhart.

Hammersmith.—Windsor Castle Hotel, 134, King Street, 7.30 p.m. A.S.E.E. West London Branch. Films evening, including colour film of the 1959 Electrical Engineers' Exhibition.

Hull.—Yorkshire Electricity Board, Ferensway, 6.30 p.m. I.E.S. Hull Centre. "Trends in Lamp Design 1884-1984," by E. E. Miles.

Leeds.—University Electrical Department Lecture Theatre, 6.30 p.m. I.E.E. North Midland Centre. "The Application of Low-Pressure Resins to some High-Voltage Switchgear Designs," by T. R. Manley, K. Rothwell and W. Gray.

London.—Savoy Place, W.C.2, 5.30 p.m. I.E.E. Measurement and Control Section. "An Analogue Electronic Multiplier using Transistors as Square-Wave Modulators," by P. Gleghorn.

Livery Hall, Guildhall, 7 for 7.30 p.m. Lightmongers' Society. Annual dinner and annual general meeting.

At the Royal Society of Arts, John Adam Street, Adelphi, Strand, W.C.2, 7 p.m. Institution of Plant Engineers. "The Constructional Problems Encountered in the Kariba Dam Project," by T. A. L. Paton.

Great George Street, Westminster, S.W.1, 5.30 p.m. Institution of Civil Engineers. Presidential address, by A. C. Hartley.

Maidenhead.—College of Further Education, Bourne Road, 7.30 p.m. A.S.E.E. Reading and Districts Branch. "Protective Equipment for Industrial Plant," by Dr. W. L. Stern.

Manchester.—Engineers' Club, 17, Albert Square, 6.15 p.m. I.E.E. North Western Centre. "The Application of Irradiation in Industry," by M. C. Crowley-Milling.

Newcastle-upon-Tyne. — Crown Hotel, Clayton Street, 7.30 p.m. A.S.E.E. Newcastle-upon-Tyne and District Branch. "Switchgear Protection."

Peterborough.—White Lion Hotel, Church Street, 7.30 p.m. Institution of Plant Engineers, Peterborough Branch. "Colour Television."

Stafford.—Swan Hotel, 7.45 p.m. I.E.E. North Staffordshire Graduate and Student Section. Repetition of Centre chairman's address.

Stoke-on-Trent.—North Stafford Hotel, 6 p.m. I.E.S. Stoke-on-Trent Group. "New Lamp Developments," by M. J. Wells.

Stranraer.—Alexandra Café, 40, George Street, 7.15 p.m. Ministry of Works. "Space Heating by Electricity," by W. M. Stevenson.

TUESDAY, 3rd NOVEMBER and WEDNESDAY, 4th NOVEMBER

London.—Connaught Rooms, W.C.2. British Electrical and Allied Manufacturers' Association. Publicity Conference.

Scarborough.—Royal Hotel. Combustion Engineering Association. Conference on "Fuel Economy through Automatic Operation."

TUESDAY, 3rd NOVEMBER to FRIDAY, 6th NOVEMBER

London.—Institute of Welding. Autumn meeting, including presidential address by E. Seymour-Semper (3rd November) and annual dinner (Park Lane Hotel, 4th November).

TUESDAY, 3rd NOVEMBER to SATURDAY, 14th NOVEMBER

Manchester.—City Hall, Deansgate. Industrial Efficiency and Safety Exhibition.

WEDNESDAY, 4th NOVEMBER

Bridgend.—Technical College. I.E.S. Cardiff Centre. Joint meeting with the Association of Mining Electrical and Mechanical Engineers. "Mine Lighting."

Dundee.—Taypark Hotel, West Ferry, 7.30 p.m. Institution of Plant Engineers, Dundee Branch. "Design and Operation of the Jodrell Bank Radio Telescope," by C. N. Kington.

Edinburgh.—Y.M.C.A., South St. Andrew Street, 6.15 p.m. I.E.S. Edinburgh Centre. "The History of Lighting," by S. S. Beggs.

Glasgow.—39, Elmbank Crescent, 6 p.m. I.E.E. South West Scotland Sub-Centre. The Fiftieth Kelvin Lecture on "The Geophysical Year 1957-58," by Sir David Brunt.

Halifax.—Crown Hotel, Horton Street, 7.45 p.m. A.S.E.E. Halifax Branch. "Control Centres," by R. G. Camp.

London.—I.E.E. London Graduate and Student Section, 3 p.m. Visit to C.E.G.B., South Eastern Division, East Grinstead, Sussex.

London School of Hygiene and Tropical Medicine, Keppel Street, Gower Street, W.C.1, 3 p.m. and 6 p.m. British Institution of Radio Engineers, Computer Group Meeting. Symposium on "Input/Output Devices."

45, Great Peter Street, Westminster, S.W.1, 7 p.m. Women's Engineering Society, London Branch. "Electrical Bowling Alleys," by D. Lockley.

Manchester. — Engineers' Club, Albert Square, 7.15 p.m. A.S.E.E. Manchester Branch. "Maintenance of Electrical Switchgear," by F. G. Thompson.

Middlesbrough.—At the Cleveland Scientific and Technical Institution. I.E.E. Teesside Sub-Centre. The Provision of Adequate Electrical Installations in Buildings—(a) "Housing," by C. C. Hyams (3 p.m.) and (b) "Commercial Buildings," by E. E. Jacobi (6.30 p.m.).

Newcastle-upon-Tyne.—King's College, 6.15 p.m. I.E.S. Newcastle-upon-Tyne Centre. "Lighting and Safety in Building Operations and Works of Engineering Construction," by J. Gordon-Scott.

Preston.—A.S.E.E. Preston Branch. Visit to Preston Royal Infirmary Electrical Departments.

Rugby.—College of Technology and Arts, 6.30 p.m. I.E.E. Rugby Graduate and Student Section. "Aluminium in the Electrical Industry," by P. J. H. Rata.

Southampton.—The University, 7 p.m. I.E.E. Southern Centre. "Review of E.H.V. Airblast Switchgear," by G. K. Simpson.

Southsea.—Royal Beach Hotel, 7.30 p.m. Institution of Plant Engineers, Southern Branch. "Distribution of Electrical Power," by J. Samson.

Wood Green.—Civic Centre, Town Hall, 8 p.m. A.S.E.E. North London Branch. "Floor Warming," by C. J. Wheeler.

THURSDAY, 5th NOVEMBER

Galashiels.—Technical College, Market Street, 7.15 p.m. Ministry of Works. "Space Heating by Electricity," by W. M. Stevenson.

Glasgow.—At the British Lighting Council, 29, St. Vincent Place, 6.30 p.m. I.E.S. Glasgow Centre. "The History of Lighting," by S. S. Beggs.

London.—Savoy Place, W.C.2, 5.30 p.m. Institution of Electrical Engineers. Ordinary meeting. "The Application of Irradiation in Industry," by M. C. Crowley-Milling.

Sunderland.—Technical College, 6.30 p.m. I.E.E. North Eastern Graduate and Student Section. "Reactor Instrumentation," by R. G. Gold.

Treforest.—Glamorgan College of Technology. I.E.S. Cardiff Centre. Joint meeting with the Association of Mining Electrical and Mechanical Engineers. "Mine Lighting."

FRIDAY, 6th NOVEMBER

Birmingham.—Council House, 7.30 p.m. I.E.S. Birmingham Centre. Jubilee ball and reception by the Lord Mayor of Birmingham.

Clacton-on-Sea.—Royal Hotel. Ipswich and District Electrical Association. Annual ball.

Coventry.—Hotel Leofric. Institution of Plant Engineers, Birmingham Branch. Annual dinner-dance.

Fawley.—Administration Building, Esso Refinery, 5.30 p.m. Society of Instrument Technology, Fawley Section. "The Safe Use of Electricity," by S. J. Emerson.

Gillingham.—Central Hotel. Institution of Plant Engineers, Kent Branch. Annual dinner and dance.

(Continued at foot of next page)

NEW PATENTS

Electrical Specifications Recently Published

The numbers under which the specifications will be printed and abridged are given in parentheses. Copies of any specification (3s 6d each including postage) are obtainable from the Patent Office, 25, Southampton Buildings, London, W.C.2

1946

13890. Halpern, O.—Surface coatings for the selective reflection and transmission of radio waves and the production thereof. 8th May, 1946. (821840.)

1947

4321. Kendall, J. W., and Ginns, D. W. —Nuclear reactors. 26th February, 1948. (821221.)

26977. Lawrence, N. Q., and Ginns, D. W.—Nuclear reactors. 7th October, 1947. (821931.)

1948

16021. Wood, W. E.—Nuclear reactors. 2nd June, 1949. (821607.)

1954

26172. Thompson Water Tube Boilers, Ltd., J.—Steam generators. 7th September, 1955. (Cognate application 7990, 18th March, 1955.) (821423.)

32694. Ferguson Pailin, Ltd.—Air or gas blast circuit-breakers. 8th December, 1955. (821223.)

36796. Metropolitan-Vickers Electrical Co., Ltd.—Methods of manufacturing tubular sheathed electric heating elements. 13th December, 1955. (821602.)

1955

2711. Sigmund Pumps, Ltd.—Pump and driving electric motor unit. 19th January, 1956. (821609.)

12801. English Electric Co., Ltd.—Dynamo-electric machines. 26th April, 1956. (821612.)

24726. Mullard Radio Valve Co., Ltd.—Semiconductor devices. 29th August, 1955. (821830.)

Next Week's Events

FRIDAY, 6th NOVEMBER (*Continued*)

Leeds.—Houldsworth School of Applied Science, The University, 7.30 p.m. Institution of Plant Engineers, West and East Yorkshire Branch. "The Jodrell Bank Radio Telescope," by C. N. Kington, followed by a film "The Inquisitive Giant."

Liverpool. — Industrial Development Centre, Paradise Street, 7.30 p.m. A.S.E.E. Liverpool and District Branch. Discussion on "Education and Training for the Electrical Industry."

London.—Savoy Place, W.C.2, 6 p.m. I.E.E. Medical Electronics Discussion Group.

Pepys House, 14, Rochester Row, S.W.1, 7 p.m. Junior Institution of Engineers. Films "Mirror in the Sky," "Ultrasonics," "Conquest of the Atom."

Newcastle-upon-Tyne. — King's College, 6.30 p.m. I.E.E. North Eastern Graduate and Student Section. "Modern Developments in High Voltage Switchgear," by W. T. Hall.

County Hotel. North East Electrical Club. Annual dinner.

Sheffield.—Maynard Arms Hotel. I.E.S. Sheffield Centre. Jubilee dinner and dance.

Wrexham.—Talbot Hotel, 7 p.m. I.E.E. Mersey and North Wales Centre. "Discrimination between H.R.C. Fuses," by E. Jacks.

FRIDAY, 6th NOVEMBER to SUNDAY, 8th NOVEMBER

Brighton.—Grand Hotel. Institution of Industrial Safety Officers. Annual conference.

SATURDAY, 7th NOVEMBER

London.—Carlton Rooms, Maida Vale, 7 p.m. Joint dance of the Graduate and Student Sections of I.E.E., I.C.E., and I.Mech.E.

28225. Westinghouse Brake & Signal Co., Ltd., and King, K. G.—A.c. voltage regulating systems. 4th October, 1956. (821833.)

29919. Stackpole Carbon Co.—Dynamo-electric brushes. 19th October, 1955. (821835.)

35142. Ferguson Radio Corporation, Ltd. —Pulse generators including phase discriminators. 28th November, 1956. (821945.)

36225. Olivetti Corporation of America.—Circuits employing bi-stable ferromagnetic elements. 16th December, 1955. (821946.)

36906. Widmann, E.—Switch mechanisms for the ignition and operation of hot-cathode electric discharge lamps. 23rd December, 1955. (821620.)

37147. Skillman & Co. Pty., Ltd., T. S.—Mounting arrangement for electrical equipment. 28th December, 1955. (821621.)

3898. British Insulated Callender's Cables, Ltd.—Joint for electric conductors. 8th February, 1956. (Addition to 775557.) (821515.)

4231. Electric & Musical Industries, Ltd. —Cathode-ray tubes. 2nd February, 1956. (821542.)

10968. British Thomson-Houston Co., Ltd.—Electro-luminescent panel. 28th March, 1956. (821543.)

15124. Telegraph Construction & Maintenance Co., Ltd.—Communication cables. 24th May, 1956. (821281.)

17917. Mullard Radio Valve Co., Ltd.—Electric sawtooth wave generator circuits, timebase circuits and the like. 31st August, 1956. (821517.)

32981. Postmaster General.—Telephone amplifying systems employing negative impedance convertors. 13th November, 1956. (821521.)

34840. Technical Ceramics, Ltd.—Devices for detecting electromagnetic radiations. 5th December, 1955. (821228.)

35692. Ionics, Inc.—Method of manufacturing electrically conductive membranes. 13th December, 1955. (821229.)

35774. General Electric Co.—Resonance radiation discharge lamps. 13th December, 1955. (821,321.)

37252. Soc. le Carbone-Lorraine.—Resistances. 29th December, 1955. (821524.)

1956

443. General Electric Co. — Testing arrangements for colour television receivers. 5th January, 1956. (821548.)

1034. General Electric Co., Ltd.—Electric motors. 11th January, 1957. (821432.)

1417. Philips Electrical Industries, Ltd.—Methods of making anisotropic permanent magnets. 16th January, 1956. (821624.)

1725. Malcolm, R. J.—Method of manufacturing electrical circuit components. 18th January, 1956. (821841.)

2253. Telefunken G.m.b.H. — Limiters for use with frequency modulated oscillations. 24th January, 1956. (821233.)

2538. British Insulated Callender's Construction Co., Ltd.—Repair of submarine cables. 25th January, 1957. (821625.)

2604. Magnethermic Corporation.—Induction heating systems. 26th January, 1956. (821626.)

2808. Ruhrchemie A.G., and Steinkohlen Elektrizitaet A.G.—Process and a fuel cell for the production of electrical energy from liquid fuels. 27th January, 1956. (821688.)

3042. Hoover, V. A.—Linear actuators. 31st January, 1956. (821411.)

3403. British United Shoe Machinery Co., Ltd. (United Shoe Machinery Corporation). —Apparatus adapted for use in assembling electrical components upon wiring boards. 4th February, 1957. (Addition to 802659.) (821525.)

3422. International Business Machines Corporation.—Logical switching circuits. 3rd February, 1956. (821322.)

3508/9. Fletcher, G. H.—Dynamo-electric machines. 29th January, 1957. (821434/5.)

3631. Siemens & Halske A.G.—Multi-channel carrier telecommunication systems. 6th February, 1956. (821842.)

4435. General Electric Co.—Travelling wave electric-discharge devices. 13th February, 1956. (821,527.)

5531. Raytheon Manufacturing Co.—Magnetrons. 22nd February, 1956. (821236.)

5698. Glover & Co., Ltd., W. T.—Joints in electric cables. 22nd February, 1957. (821324.)

6055. General Electric Co., Ltd.—Methods of life testing electric-discharge devices. 27th February, 1957. (821530.)

6336. Philips Electrical Industries, Ltd. —Systems for high-frequency heating of work pieces. 29th February, 1956. (821845.)

6465. Lignes Télégraphiques et Téléphoniques. — Non-metallic ferromagnetic materials and methods of manufacturing same. 1st March, 1956. (Addition to 820853.) (821325.)

8307. Standard Telephones & Cables, Ltd.—Signalling network. 16th March, 1956. (821630.)

8598. International Business Machines Corporation.—Electronic control and coupling circuits. 20th March, 1956. (821632.)

8693. British Telecommunications Research, Ltd.—Supervisory arrangements for use in telecommunication systems. 13th March, 1957. (821631.)

9138. Philips Electrical Industries, Ltd. —Method of manufacturing non-metallic ferromagnetic bodies and to bodies thus manufactured. 23rd March, 1956. (821633.)

11173. Det Store Nordiske Telegrafselskab A.S.—Means for the prevention of rebounding in apparatus and machines, notably for use in telecommunication systems. 12th April, 1956. (821440.)

11328. Philips Electrical Industries, Ltd. —Transistor amplifiers. 13th April, 1956. (821531.)

12469. Plessey Co., Ltd.—Mounting saddles for electric valve holders. 20th May, 1957. (821853.)

13239. General Electric Co., Ltd.—Transistor switching arrangements. 26th April, 1957. (821765.) 13909. Transistor switching circuits. 26th April, 1957. (821766.)

13918. Southern Instruments, Ltd.—Cathode-ray oscillographs. 9th May, 1957. (821243.)

16150. Compagnie Générale d'Electricité. —High tension cable installations. 24th May, 1956. (821248.)

16589. General Electric Co., Ltd.—Receivers for use in electric signalling systems. 27th May, 1957. (821767.) 16590. Electric oscillator systems. 27th May, 1957. (821768.)

17069. McMillan, E. B., and Redheffer, R. M.—Dielectric walls for transmission of centimetric radiation. 1st June, 1956. (821250.)

17394. Bird Electronic Corporation.—Reflectionless termination units for coaxial transmission lines. 5th June, 1956. (821329.)

17486. Napier & Son, Ltd., D.—Gas cooling of electric commutators. 23rd May, 1957. (821444.)

(*Continued on page 583*)

NEW PATENTS (*continued*)

17824. Landis & Gyr, Ltd.—Device for use with electricity meter and prepayment mechanisms. 6th June, 1957. (821699.)

18006. Commissariat à l'Energie Atomique. —Fissionable materials for use in nuclear reactors and in the methods of manufacturing such material. 11th June, 1956. (821639.)

18174. Sulzer Freres S.A.—Steam power plants employing a plurality of steam generators connected in parallel and provided with intermediate reheaters. 12th June, 1956. (821700.)

20034. Telephone Manufacturing Co., Ltd.—Electrical capacitors. 11th April, 1957. (821418.)

25986. Licencia Patent-Verwaltungs G.m.b.H.—Single anode mercury pool cathode rectifiers. 24th August, 1956. (821649.)

26632. Plessey Co., Ltd.—Electrical apparatus. 21st August, 1957. (Addition to 800992.) (821651.)

27168. Lustraphone, Ltd.—Electro-acoustic transducers. 5th September, 1957. (821707.)

27530. Reyrolle & Co., Ltd., A.—Electric busbar systems. 7th September, 1956. (Addition to 758252.) (821255.)

28766. Telephone Manufacturing Co., Ltd.—Manufacture of electrical capacitors. 5th September, 1957. (821419.)

29558. Mullard, Ltd.—Photo-conductive cells. 16th August, 1957. (821653.)

29648. United Kingdom Atomic Energy Authority.—Heat transfer systems in nuclear reactor fuel elements. 17th September, 1957. (821861.)

29649. United Kingdom Atomic Energy Authority.—Transistor bi-stable circuits. 17th September, 1957. (821256.)

30853. United Kingdom Atomic Energy Authority.—Nuclear reactors. 18th October, 1957. (821655.)

31961. General Electric Co., Ltd.—Metal vapour electric arc convertors. 10th October, 1957. (821864.)

32903. British Thomson-Houston Co., Ltd.—Luminescent materials. 29th October, 1957. (821865.)

33372. Telephone Manufacturing Co., Ltd.—Electrical capacitors. 29th October, 1957. (821658.)

33528. Fielden Electronics, Ltd.—Float signalling equipment. 23rd January, 1958. (821868.)

34247. United Kingdom Atomic Energy Authority.—Electric lighting accessories. 10th October, 1957. (821461.)

34328. British Thomson-Houston Co., Ltd.—Air or gas blast circuit-breakers. 17th January, 1958. (821659.)

34706. General Electric Co., Ltd.—Protective arrangements for electrical apparatus. 12th November, 1957. (821347.)

34742. Sylvania Electric Products, Inc.—Discharge lamp and phosphor therefor. 13th November, 1956. (821261.)

36004. United Kingdom Atomic Energy Authority. — Fuel elements for nuclear reactors. 25th November, 1957. (821263.)

36782. Parsons & Co., Ltd., C. A.—Removal of fission products from nuclear reactors. 27th November, 1957. (821289.)

37227. British Insulated Callender's Cables, Ltd., and British Transport Commission.—Overhead electrification systems for railways. 4th December, 1957. (821264.)

37898. Automatic Telephone & Electric Co., Ltd.—Connecting arrangements. 26th November, 1957. (821265.)

38275. General Electric Co.—Silicon semiconductive devices. 14th December, 1956. (821663.)

38717. Collins Radio Co.—System for detecting and transmitting frequency modulated signals. 19th December, 1956. (821873.)

39558. M-O Valve Co., Ltd.—Thermionic valves incorporating window seals. 20th December, 1957. (821771.)

39559. General Electric Co., Ltd.—Window seals for electrical devices. 20th December, 1957. (821772.)

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96. Hoover, Ltd.—Cable entries. 31st December, 1957. (821666.)

936. Vigilant Switchgear, Ltd.—Snap-action electric switches. 10th January, 1958. (821267.)

1318. Telephone Manufacturing Co., Ltd. —Electrical apparatus and devices for use therein. 13th January, 1958. (821723.)

1443. Union Carbide Corporation, formerly Union Carbide & Carbon Corporation. —Electric incandescent lamps. 15th January, 1957. (821465.)

1459. Electric & Musical Industries, Ltd. —Apparatus in which timing information is conveyed by electrical signals. 10th January, 1958. (821880.)

1484. Westinghouse Electric International Co.—Dynamo-electric machines. 15th January, 1957. (821569.)

2388. Plessey Co., Ltd.—Contact operating electromagnetic vibrators. 23rd January, 1958. (821357.)

2474. General Electric Co., Ltd.—Arrangement for producing a variable colour lighting effect. 23rd January, 1958. (821668.)

2672. M-O Valve Co., Ltd.—Thermionic valves. 24th January, 1958. (821773.)

2673. General Electric Co., Ltd.—Methods of attaching carbon bodies to metal bodies. 24th January, 1958. (821774.)

2691. Rowlands Electrical Accessories, Ltd., and Adie, K. S.—Illuminant enclosures. 22nd April, 1958. (821358.)

3651. Wild-Barfield Electric Furnaces, Ltd.—Metallurgical heat treatment furnaces. 3rd February, 1958. (821469.)

3781. British Insulated Callender's Cables, Ltd.—Manufacture of electrically insulated wires. 3rd February, 1958. (821669.)

4207. Chloride Electrical Storage Co., Ltd.—Electric batteries. 15th January, 1958. (821572.)

6134. Midland Electric Manufacturing Co., Ltd.—Combined fire-screen and space heater. 24th February, 1958. (821884.)

6852. Clang, Ltd., Austen, H. E., and Harwood, C. D.—Means for retaining an electric switch dolly on its mounting. 26th March, 1958. (821670.)

6887. Marconi's Wireless Telegraph Co., Ltd.—Repetitive signal systems. 16th December, 1957. (821575.)

7048. Soc. de l'Accumulateur Fulmen.—Cover for an accumulator battery. 4th March, 1957. (821270.)

7787. Modern Telephones (Great Britain), Ltd.—Mechanically interlocked push-button electric switches. 10th March, 1958. (821474.)

8480. Compagnie Générale de Radiologie.—X-ray generator tubes. 14th March, 1957. (821475.)

8992. Metropolitan-Vickers Electrical Co., Ltd.—Electrical terminal connections. 7th March, 1958. (821271.)

9722. British Thomson-Houston Co., Ltd.—Safety apparatus for winder plants. 25th March, 1958. (821672.)

10146. Chloride Batteries, Ltd.—Tubular type plates for electric accumulators. 11th March, 1958. (Cognate applications 30494, 30th September, 1957; 37803, 4th December, 1957.) (821577.)

10186. Sperry Rand Corporation.—Ferrite members in microwave conductors. 28th March, 1957. (820631.)

10333. Fernseh G.m.b.H.—Television apparatus including a photoconductive camera tube. 29th March, 1957. (821673.)

10750. British Thomson-Houston Co., Ltd.—Cooling system control. 2nd April, 1958. (821674.)

10842. Commissariat à l'Energie Atomique. —Neutron detectors. 3rd April, 1957. (821367.)

11007. Marconi's Wireless Telegraph Co., Ltd.—Radar systems. 3rd February, 1958. (821675.)

12123. Electric & Musical Industries, Ltd.—Sound transducing apparatus. 14th April, 1958. (821580.)

12910. English Electric Valve Co., Ltd.—Coupling and holding devices for travelling wave tubes. 27th November, 1957. (821274.)

13197. Forges et Ateliers de Constructions Electriques de Jeumont.—Railway track circuits. 25th April, 1957. (821373.)

15588. Ugine-Infra.—Supply of electrical energy in controlled amounts. 16th May, 1957. (821279.)

15976. De France, H. G.—Colour television system. 20th May, 1957. (821246.)

16529. Standard Telephones & Cables, Ltd.—Circuit arrangement for differential correction of television receivers. 24th May, 1957. (821119.)

17342. Westinghouse Electric International Co.—Electric circuit interruptors. 31st May, 1957. (821379.)

19304. Philips Electrical Industries, Ltd. —Glow discharge tubes. 19th June, 1957. (820530.)

20502. Philips Electrical Industries, Ltd. —Frequency doubling circuit arrangements. 28th June, 1957. (821291.)

22514. Western Electric Co., Inc.—Ferro-electric and piezo-electric devices and crystal elements therefor. 16th July, 1957. (821292.)

24878. Research-Cottrell, Inc.—Method for electrostatically precipitating suspended particulate material from gases. 7th August, 1957. (820432.)

25655. Sorensen-Ardag.—Voltage regulator. 14th August, 1957. (821089.)

25972. Western Electric Co., Inc.—Electronic discharge devices incorporating electron lenses. 16th August, 1957. (821295.)

27032. United-Carr Fastener Corporation.—Electrical connectors and electrical assemblies including such connectors. 27th August, 1957. (821190.)

27048. Lear, Inc.—Transistor oscillator. 28th August, 1957. (821296.)

27385. Philips Electrical Industries, Ltd. —Magnetic brakes. 30th August, 1957. (821122.)

27416. Deutsche Gold und Silber Scheideanstalt vorm. Roessler.—Homogeneous fuel elements for nuclear fission reactors. 30th August, 1957. (821297.)

28554. Collins Radio Co.—Frequency and phase discriminator. 10th September, 1957. (821484.)

29516. Hubbell, Inc., H.—Electrical coupling device for industrial use. 19th September, 1957. (820538.)

31740. Bendix Aviation Corporation.—Electrical two-part couplings. 10th October, 1957. (821299.)

31860. Edgerton Germeshausen & Grier, Inc.—Cathode-ray apparatus. 11th October, 1957. (821394.)

33632. Siemens & Halske A.G.—Measuring arrangements for determining mean values, and incorporating electrical integrating devices. 28th October, 1957. (821302.)

35644. Standard Telephones & Cables, Ltd.—Plastic insulated multi-conductor cable. 15th November, 1957. (821303.)

37627. General Electric Co.—Production and control of electron beams. 3rd December, 1957. (821201.)

38357. Siemens-Reiniger-Werke A.G.—Rotating anode X-ray tubes. 10th December, 1957. (821305.)

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3625. Western Electric Co., Inc.—Reflex klystrons. 4th February, 1958. (821212.)

5114. Hoover, V. A.—Control of electrically driven rectilinear actuators. 31st January, 1956. (Divided out of 821411.) (821413.)

6404. Siemens & Halske A.G.—Electrical switching arrangements. 27th February, 1958. (821406.)

15885. Siemens-Reiniger-Werke A.G.—Electrodes for generating a high frequency rotational magnetic field. 16th May, 1958. (821494.)

CONTRACT INFORMATION

Accepted Tenders and Prospective Electrical Work

CONTRACTS OPEN

Where "Contracts Open" are advertised in our "Official Notices" section the date of the issue is given in parentheses

Australia.—Postmaster General's Department, Melbourne. 17th November. Selector maintenance parts. (E.S.B. 25149/59. Ten/42857.)* 1st December. Long line equipment maintenance parts. (E.S.B. 24633/59. Ten/42799.)*

Southern Electric Authority of Queensland, Brisbane. 16th December. One 60 MVA transformer. (E.S.B. 25221/59. Ten/42885.)*

Basildon.—U.D.C. 23rd November. Class "A" street lighting equipment. (See this issue.)

Brigg.—U.D.C. 19th November. Storm water pumps complete with electric motors, starters and accessories, and one oil engine-driven generator, for sewage scheme. John H. Haiste & Partners, consulting engineers, Belmont House, 20, Wood Lane, Headingley, Leeds, 6.

Burma.—Burma Purchase Board, Rangoon. 9th November. Mercury vapour and discharge lamps. (E.S.B. 25064/59. Ten/42838.)* Cable. (E.S.B. 25062/59. Ten/42837.)*

Deal.—Borough Council. 7th November. Two 60 kW diesel alternators. A. E. Parry, borough water engineer, Water Department, St. Richards Road.

Essex.—County Council. Electrical engineering services at Essex Institute of Agriculture. (See this issue.)

Formosa.—Central Trust of China, Taipei. 14th November. Armoured power cable. (E.S.B. 24793/59/I.C.A. Ten/42764.)*

Honduras.—Empresa Nacional de Energia Eléctrica, Tegucigalpa. 15th November. Conductors. (E.S.B. 25077/59. Ten/42854.)*

India.—India Supply Mission. 5th January. Four water tube boilers for Amarkantak power station. (See this issue.)

Iraq.—Baghdad Water Supply Administration. 30th November. Electrically driven pumps, air blowers, transformers and control panels. (E.S.B. 24842/59. Ten/42819.)*

Kuwait.—Department of Electricity, Water and Gas. 11th November. Mercury vapour and g.l.s. floodlights. (E.S.B. 24854/59. Ten/42773.)*

Manchester.—Corporation. 23rd November. Switchgear equipment and two 750 kVA transformers. (See this issue.)

Mitcham.—Corporation. 14th November. Street lighting equipment. (See this issue.)

New Zealand.—G.P.O., Wellington. 27th November. Capacitors. (E.S.B. 24922/59. Ten/42828.)*

Auckland Electric Power Board. 4th December. 22 kV switchgear. (E.S.B. 24754/59. Ten/42814.)*

Pakistan.—Director General, Department of Supply and Development, Karachi. 5th November. Transistor radio sets. (E.S.B. 24726/59/I.C.A. Ten/42739.)*

South Africa.—Stores Department, South African Railways, Johannesburg. 13th November. Battery chargers. (E.S.B. 24804/59. Ten/42778.)* Superheater elements. (E.S.B. 24801/59. Ten/42827.)* 20th November. Breaker control and closing relays. (E.S.B. 25069/59. Ten/42848.)*

Union Tender Board, Pretoria. 20th November. Diesel-electric generating sets. (E.S.B. 24670/59. Ten/42779.)* 25th November. Radio intercommunication sets. (E.S.B. 24744/59. Ten/42731.)*

Pretoria Electricity Department. 15th December. Piping equipment for Rodiwal power station. (E.S.B. 24631/59. Ten/42820.)*

Sudan.—Stores Department, Sudan Railways, Khartoum. 21st December. Passenger and service lifts at the New Grand Hotel. Bids to Sudan Government Purchasing Agent, 3-5, Cleveland Row, St. James's, London, S.W.7. (E.S.B. 24210/59. Ten/42870.)*

Taunton.—Borough Council. 6th November. Electrical goods (Schedule D) for one year commencing 1st January next. K. A. Horne, town clerk, Municipal Buildings.

Tottenham.—Borough Council. 30th November. Electric lamps (Schedule 5) for the year commencing 1st April next. M. Lindsay Taylor, town clerk, Town Hall, N.15.

Trinidad.—Trinidad and Tobago Electricity Commission, Port of Spain. 30th November. Four electrically driven pumps, one 1,250 kVA transformer, cables, etc. (E.S.B. 25243/59. Ten/42877.)*

United States.—Bureau of Reclamation, Denver, Colorado. 12th November. Generator voltage switchgear assemblies and bus structures for Upper and Lower Molina power plants. (E.S.B. 24798/59. Ten/42777.)*

* Specifications may be inspected at the Export Services Branch, Board of Trade, Lacon House, Theobald's Road, London, W.C.1 (Chancery 4411; extension 769).

WORK IN PROSPECT

Particulars of new works and building schemes for the use of electrical installation contractors and traders. Publication in this section is no guarantee that electrical work is definitely included. Alleged inaccuracies should be reported to the Editors

Ashington (Northumberland). — Houses (285), Sixth Avenue site; U.D.C. surveyor.

Birmingham.—Houses (68), Rubery; A. G. Sheppard Fidler, city architect, Civic Centre.

Blandford (Dorset).—Houses and bungalows (45), Pimperne; clerk, 10, Market Place.

Bolton.—Houses and flats (375), Platts Hill; Sutton Dwellings Trust, Victoria House, Southampton Row, London, W.C.1.

Bristol.—Works extensions; G. B. Britton & Sons, Ltd., Lodge Road, Kingswood.

Bury St. Edmunds.—Home for the aged; Grenfell Baines and G. Hargreaves, architects, 12/24, Guildhall Street, Preston.

Cambridge.—Block of buildings for Gonville and Caius College; Colin St. John Wilson, architect, Scroope Terrace.

Chadwell St. Mary.—Old people's hostel; Clifford Culpin, architect, 39, Doughty Street, London, W.C.1.

Colchester.—Bungalows (85), Rowhedge; C. Paine & Sons, Ltd., 690, Lea Bridge Road, London, E.10.

Coventry.—Works, Bishop Street; Salt Engineering Co., Ltd., St. John Street.

Crewe.—Patients' villas, nurses' home, staff houses, administrative block, etc., at Cranage Hall, Holmes Chapel; Manchester Regional Hospital Board, Cheetwood Road, Manchester, 8.

Dunmow.—Secondary school extension; Gerald Lacoste, architect, 247, Regent Street, London, W.1.

Dunstable.—Flats (116), Downside estate; borough surveyor.

Showrooms and offices, London Road North; G. E. Wallis & Sons, Ltd., 231, Strand, London, W.C.2.

Eastbourne.—Shops and offices, Terminus Road; Walter Llewellyn & Sons, Ltd., South Street.

Edinburgh.—Four-storey headquarters, Lady Lawson Street, for National Coal Board; R. Anderson, Kininmonth & Paul, architects, 16, Rutland Square, Edinburgh.

Fort William.—Houses (46), Claggan site; J. A. W. Grant, architect, 36, Melville Street, Edinburgh.

Guildford.—Factory, Woodbridge Industrial estate; L. M. Ballamy, Ltd., Albury Road.

Halesowen.—Dwellings (80), Islington; A. T. Butler & Co., architects, 31, Priory Street, Dudley.

Huntingdon.—Flats (36); borough surveyor.

Hunts.—Extensions to secondary school (£151,000) and three new classrooms at primary school (£31,250), Stanground; county architect, Huntingdon.

Secondary modern school, Orton (£155,900); A. W. Ambery, Ltd., Queen Street Works, Geddington Cross.

Leicester.—Fire station, Aikman Avenue (£43,000); city architect.

Liverpool.—Factory, Woodend Avenue, Speke; North Western Industrial Estates, Ltd., Derby House, Liverpool, 2.

London.—Office block, Heneage Lane, Bury Street and Creechurch Lane, E.C.; Gotch & Partners, architects, 8, City Road, E.C.1.

Office block, Red Lion Square, Holborn; F. G. Minter, Ltd., 4, Buckingham Gate, S.W.1.

Workshop block for Royal College of Art, Kensington Gore; H. T. Cadbury-Brown, architect, 17, Clarges Street, W.1.

Flats and maisonnettes (70), Aldrington Road, Wandsworth; borough engineer and architect, Municipal Buildings, S.W.18.

Loughborough.—Development of Shelthorpe House estate (72 houses and 76 bungalows); William Davis & Co. (Leicester), Ltd., Loughborough.

Maidstone.—Old people's bungalows (40), Park Wood estate; borough engineer, Palace Avenue.

Merioneth.—Extensive additions to Ffestiniog Secondary school; county architect, County Offices, Lombard Street, Dolgellau.

Newcastle-on-Tyne.—Helicopter landing station and multi-storey parking garage; Aycliffe Properties, Ltd., P.O. Box 1, Newton Aycliffe, Co. Durham.

Research block at King's College; John Laing & Sons, contractors, Dalston Road, Carlisle.

Newton Aycliffe (Co. Durham).—Houses (51); G. A. Goldstraw, chief architect, Aycliffe Development Corporation.

Oldbury.—Houses (78), Stone Street and Lodge Street development; Wood & Kendrick & Williams, surveyors, 57, Colmore Row, Birmingham.

Oxford.—Two 15-storey blocks of flats, Blackbirds Leys estate; city architect.

Rawmarsh.—Houses (212), Monkwood and Sandhill, as further phases of slum clearance scheme; J. R. S. Creighton, surveyor, Parkgate, West Riding, Yorks.

Rochester.—Houses (100); J. A. Peel, city surveyor, 66, Maidstone Road.

St. Helens.—Three-storey block of shops and maisonnettes, Dalehead Place, East Lancashire Road estate; M. Ward, borough engineer, Town Hall.

Spalding.—Bungalows for old people, Love Lane (£25,533); S. Hale & Son (Contractors), Ltd., Woolram Wygate, Spalding.

Weymouth.—Flats and maisonnettes (46), Chickerell Road; W. G. Taylor & Son, Ltd., Boot Hill.

Wokingham.—Dwellings (81), Norreys Barn estate; borough surveyor.